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ABSTRACT

The instructional materials and classroom activities described in the document are intended to aid teachers in grades four through six develop and implement educational programs dealing with energy-related issues. The document is presented in four sections. Section I explains the organization of the document and summarizes how teachers should implement activities and assess student performance. Section II consists of a matrix of activities described in the document. Information is presented on grade level, time required, and subject matter. Section III describes learning activities in six areas: (1) sources of energy, (2) uses of energy, (3) conversion of energy from one form to another, (4) impact of energy use on the environment, (5) limits of the earth's resources, and (6) the future. For each activity, information is presented on title, concept, time, implementation, materials, and optional activities. Activities involve students in working crossword puzzles, completing handouts, discussing energy issues in class, comparing energy sources, working on library research projects, designing and testing kits and windmills, defining energy terms, playing educational games involving energy conversion systems and pollution, and performing simple scientific experiments dealing with wind power, solar energy, and soil types. The final chapter presents information on student assessment. Topics discussed include suggested test items, how to use suggested test items, and origin of test items. (DB)

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IMPLEMENTATION HANDBOOK

ENERGY AND CONSERVATION EDUCATION

Activities for the Classroom

Grades 4-6

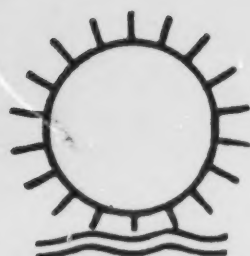
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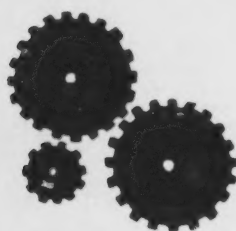
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SOURCES



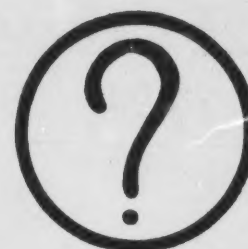
USES



CONVERSIONS



IMPACTS



FUTURE



LIMITS



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CREDITS

The Learning Activity Packages are the result of a three-year development effort by Energy & Man's Environment and educational agencies in the Northwest. The development project was designed to produce practical and objective energy and conservation education classroom resources.

Phase I of the development process began in 1972, when educators and industry representatives met under the leadership of the Washington State Department of Public Instruction to establish a framework of goals and objectives essential to an understanding of energy and energy-related environmental issues. Six principal topic areas were identified: Sources of Energy, Uses of Energy, Conversion of Energy, Impacts of Energy, Limits of Energy and Future Sources of Energy. Each topic was described in the form of multidisciplinary goals, concepts and objectives. The framework was expanded into an Activity Guide and subjected to testing and revision. This Guide appeared at the beginning of the energy dilemma and served as a model for many subsequent efforts across the United States. Contributors to the first edition of the Guide were:

La Von Bucher, Teacher
Dick Downie, Engineer
Dan Horn; Professor, Earth Science
David Kennedy; Administrator,
Environmental Education
Joyce Lekas, Teacher
Don Orlich; Professor, Education

Thomas Ris, Communications
Elaine Smith, Teacher
Loretta Smithburg, Teacher
Dave Stronck; Professor,
Education/Biology
Lyle Wilhelmi; Administrator
Science

The second phase of the instructional materials development began in 1973. With the assistance of state departments of education, EME selected and contracted with six outstanding school districts to develop teacher-made instructional materials based on the Activity Guide framework. The districts selected were Cheyenne, Wyoming; Everett and Olympia, Washington; and Beaverton, Eugene and Medford, Oregon. Key Area Resource Persons in Phase II were Bob Larson, Larry Torgerson, Floyd Smith, Lois Helton, and Lyle Wilhelmi. Phase II continued for nine months and produced a wide range of multidisciplinary, 1-12 instructional resources.

In September, 1974, Phase III of the curriculum writing effort began with the awarding of a substantial contract to the Beaverton, Oregon School District. Under the direction of Lois Helton, a team of master teacher writers scrutinized, refined and rewrote the materials produced in Phase II. The team was composed of Dan Grimes, Mabel Lund, Shirley Barnes, and Ted Parker. Essential to the success of this effort were Dalton Plunkett and Harold Wik, who provided leadership and facilitated the development process. Chloe Poole and Omer Gosnell added their creative skills to design and illustration.

Concurrent with the initiation of Phase III, a skilled group of writers from business, industry, government and the private sector came together to revise and strengthen the Activity Guide. Utilizing several hundred evaluations from teacher-users, the writers refined the conceptual framework, expanded the resource material and created a new organizational structure. The result was a set of seven Activity Guides described by one leading curriculum administrator as "the single richest source of energy and conservation education teaching ideas available anywhere." The new material was used by Phase III writers and keyed to the expanded framework of topics, concepts, and instructional objectives. Authors of the new Activity Guide were:

La Von Bucher, Teacher	Dave Kennedy; Administrator,
George Carter, Energy Information	Environmental Education
Don Charnley; Attorney, Legislator	Al Krieg, Engineer
Ed Dalton, Teacher	Ron Lamb; Professor, Biology
Roberta Davis, Parent	Keith Loeffler, Energy Informa-
Dick Downie, Engineer	tion
Lois Helton, Teacher	Jack Vogel, Energy Informati
Dan Horn; Professor, Earth Science	Harold Wik; Administrator,
Bob Keesey, Economist	Curriculum
	Lyle Wilhelmi; Administrator,
	Curriculum
	Warren Wolf, Art School Director

In 1975, Learning Activity Packages from Phase III were placed in Beaverton, Oregon and Everett, Washington schools and subjected to vigorous classroom evaluation. External, third-party assessment was instrumented and supervised by Dr. Quentin Clarkson of Portland State University. Supervision at the school district level was managed by Wayne Neuberger, Evaluation Specialist for the Beaverton School District, and Jim Pringle in the Everett, Washington School District. Teacher evaluators in the Beaverton and Everett School Districts included:

Jim Pringle	Cascade High School
Marlene Lindstrand	Cascade High School
Dave Dailey	Cascade High School
Elliot Cheap	Cascade High School
Tony Jongejan	Everett High School
Shirley Barnes	West Tualatin View Elementary
Cindy Claridge	Beaverton School District #48
Jackie Fitzgerald	William Walker Elementary
Maria Gander	West Tualatin View Elementary
Dan Grimes	William Walker Elementary
Lois Helton	Five Oaks Middle School
Pat Kingman	Aloha Park Elementary
Mabel Lund	Mountain View Middle School
Rowena Marks	West Tualatin View Elementary
Jim Miller	Aloha High School
Shari Noldge	William Walker Elementary
Court Ofelt	Mountain View Middle School
Ted Parker	Aloha High School
Joanne Profitt	Five Oaks Junior High School
Kathy Vassias	Beaverton School District #48
Bruce Weitzel	Five Oaks Middle School
John West	Five Oaks Middle School

The final step in development, Phase IV, began in September, 1976. Under the direction of Dan Grimes, EME Oregon Coordinator, and Duane Altig, Parkrose School District, each Learning Activity Package was examined and revised based upon the field test evaluation. Production assistance was provided by Darlene McLaughlin, Sharon Scherner, Jane Aldrich, G. Sue McCormack, Bill Edwards, Rhea Zaldain, Marie Sullivan, Evelyn Ekstrand, Al Hughes, Mary Linton, and Linda Hileman.

Many persons not specifically named here contributed personally to the success of this major undertaking. Among those not already mentioned were Helen White, Diane Nelson, Luanne Campbell, Marcia Whitelock, and Doris Graffam. To those teachers, students, curriculum specialists and parents who remain unnamed but gave so freely of their time and skill, we extend our sincere appreciation. We hope our effort will materially benefit our teaching colleagues.

John C. Jones, D.Ed.
President
Energy & Man's Environment
Portland, Oregon

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 - 2. Uses
 - 3. Conversions
 - 4. Impacts
 - 5. Limits
 - 6. Future

III. LEARNING ACTIVITIES

Section One — Sources

Goal:

It is essential that each person know that there are many sources of energy.

Section Two — Uses

Goal:

It is essential that each person know that people are dependent upon energy.

Section Three — Conversion

Goal:

It is essential that each person know that energy can be converted from one form to another.

Section Four — Impacts

Goal:

It is essential that each person know how humankind's use of energy creates an impact on the environmental and economic systems.

Section Five — Limits

Goal:

It is essential that each person know that the earth's resources are limited.

Section Six — Future

Goal:

It is essential that each person know that new energy sources and more efficient systems, accompanied by different consumption practices, may alter the world energy dilemma.

IV. STUDENT ASSESSMENT

- A. Using The Suggested Test Items
- B. Origin Of Test Items
- C. Types Of Suggested Test Items
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SOURCES

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FUTURE

ASSESSMENT

ACTIVITY NOTEBOOK
IMPLEMENTATION HANDBOOK

Overview

Energy & Man's Environment (EME) is a unique educational program developed to prepare instructional materials dealing with energy education--primary grades through high school. EME was initiated in 1972 by the Public Power Council of the Northwest Public Power Association in cooperation with leading educators in the region. In 1973, members of the Northwest Electric Light & Power Association (NELPA) joined the program. In 1976, additional business, governmental and educational agencies joined the Northwest consortium to strengthen EME efforts. The precedent of cooperative effort has resulted in an educator-directed, non-profit corporation supported by resources from business, government, education, and the private sector. The program has one goal--to make the subject of energy understandable both to the educator and the student. EME's primary concern is to present energy-related issues from all points of view accurately and objectively. EME offers conferences, workshops, seminars, speakers, and special programs to meet the energy-related needs of educators. Each activity can be "custom tailored" to meet the specific needs and interest of the participants.

The educational materials presented in the EME Activity Notebooks 1-12 are an example of the teacher-prepared materials offered by EME for use by classroom teachers in presenting energy-related issues.



Organization

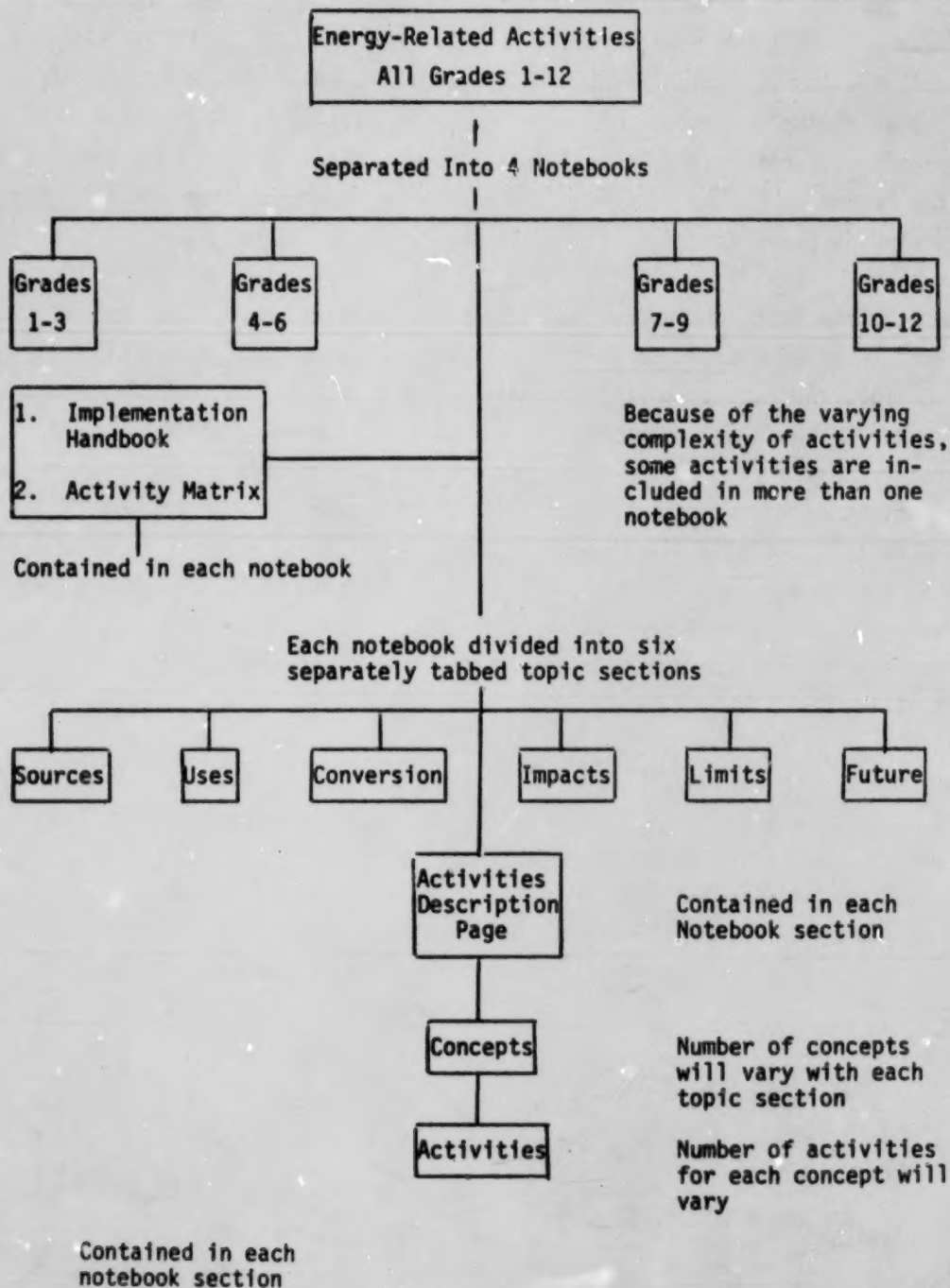
There are four notebooks covering all grade levels 1-12. The arrangement of the notebooks are (1-3), (4-6), (7-9), (10-12). Because of the varying complexity and multidisciplinary nature of the activities, each notebook includes an implementation handbook and an activities matrix which identifies topics, activities, grade levels, subject matter areas, etc. for quick reference by the teacher. The individual notebooks contain activity description pages for each of the six topics in the notebook.

The six principal sections or topics in each notebook are: Sources of Energy, Uses of Energy, Conversion of Energy, Impacts of Energy, Limits of Energy, and Future Sources of Energy. Each topic contains a number of concepts which are necessary to a fundamental understanding of the general topic area. Listed under each concept are simply stated objectives or activities which are multidisciplinary in nature and vary in their complexity. Included within each of the activities is a complete breakdown as to the time needed for implementation of the materials, implementation procedures, assessment procedures, a suggested career education activity, and other information necessary for successful classroom use of the activities.

The following diagram will help to explain the notebook organization. The concepts which provide an overall guide to the intent of the main topic are within the description pages of the notebook. The activity objectives indicate the expected level of outcome from the materials to be presented in the classroom. Each activity is the "hands-on" experience which the student will accomplish to meet the expected outcome.



EME ACTIVITY NOTEBOOK ORGANIZATION



Teacher Implementation

The materials are designed to be used by classroom teachers in all grade levels. It is hoped that the instructors will feel free to alter, adapt, or change the activities to meet their own particular classroom needs and the needs of their students.

Some of the skills and concepts in the activities should be presented more than once to any given group of students. Therefore, in some instances, it may be desirable to repeat the activity at another grade level--either in its original or in an altered form.

Most of the activities require the students to be actively involved, both with other students and in actual use of the materials. This may require some adjustment of the traditional classroom situation.

There are many activities which contain handouts that can be duplicated for student use.

The actual use of the notebooks is relatively simple. Steps to locating a suitable activity are:

1. Select appropriate notebook.
2. Read activities matrix to select an activity title and number which most closely matches your interest, grade level, and subject matter.
3. Turn to the topic section of the notebook indicated by the activities matrix.
4. Read the description of the activity you selected, and then turn to the activity number in the notebook.
5. Read the activity.
6. Complete the activity. (Repeat these steps for additional activities.)



Assessment

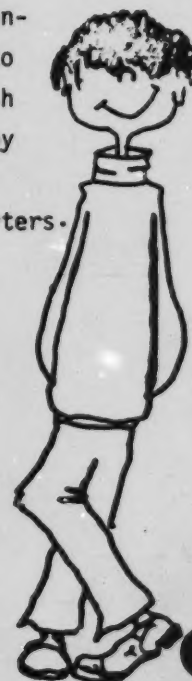
Included in each notebook are a series of sample test items for the teacher who wishes to pinpoint areas of weakness and strength in the individual student's knowledge of energy topics.

The test items are written so as to be easily understood by a majority of students. The sample questions are not definitive items and are not intended to be the final word on the materials in the notebook. Each of the activities has its own assessment procedures and these should also be utilized by the instructor. The test items may be used as an indicator of the general skill and knowledge level of students prior to the implementation of EME Lesson Plan Notebooks, or as a check on the retention level of students who have been presented materials from the EME Lesson Plan Notebooks. It is recommended that the teacher remain the ultimate judge as to the effectiveness of the activities as they are presented to the students, either in their original or instructor-altered form.

Follow-Up

The materials contained in the notebooks are continually undergoing extensive field testing and revisions to obtain the best possible materials to present to students. In the event that you, as a classroom teacher, wish to contribute more to the program of energy education, EME would be happy to hear from you. If you have any suggestions which could improve any phase of the organization, activities, etc., please contact EME headquarters.

Duane K. Altig

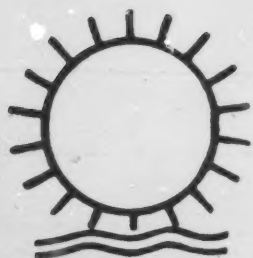


ACTIVITY/SUBJECT MATTER
MATRIX

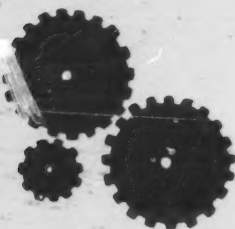
**ENERGY AND
CONSERVATION
EDUCATION**

Activities for the Classroom

Grades 4-6



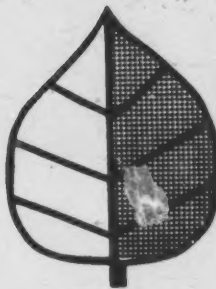
SOURCES



USES



CONVERSIONS



IMPACTS



FUTURE



LIMITS

INDEX
ACTIVITY/SUBJECT MATTER MATRIX
SOURCES (4-6)

Activity #	ACTIVITY TITLE	Grade Level	Time In 30 Min. Class Per.	SUBJECT MATTER AREAS					
				Math	Lang. Arts	Science	Soc. Studies	Art	Career Aware- ness
1	"Energy Sources and Measurements"	6	2		X				X
2	"Some Things Are Renewable And Others Are Not"	4-5	3			X			X
3	"Sources of Energy From Past To Present"	5-6	12			X	X	X	X
4	"Our Mr. Sun"	5-6	4			X		X	X
5	"Energy From The Sun"	5-6	2			X			X
6	"Drawing Relay"	5-6	1		X			X	X
7	"Windmills, Kites and Gliders"	4-6	18			X		X	X

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ACTIVITY/SUBJECT MATTER MATRIX
SOURCES (4-6)

Activity #	ACTIVITY TITLE	Grade Level	Time In 30 Min. Class Per.	SUBJECT MATTER AREAS						
				Math	Lang. Arts	Science	Soc. Studies	Art	Career Aware- ness	
8	"Questioning 'Yes or No?'"	4-6	1		x				x	

INDEX
ACTIVITY/SUBJECT MATTER MATRIX
USES (4-6)

Activity #	ACTIVITY TITLE	Grade Level	Time In 30 Min. Class Per.	SUBJECT MATTER AREAS						
				Math	Lang. Arts	Science	Soc. Studies	Art	Career Aware- ness	Creative Drama
1	"I Can Reduce My Use"	5-6	2	X			X		X	
2	"Paper, Paper, Paper, - Let's Conserve!"	4-6	Sev.	X	X	X	X	X	X	
3	"Am I Energy-Wise?"	5	2		X	X			X	
4	"The Last Three"	5-6	1		X	X			X	
5	"Peter and Alice in No-Energy Land"	4-5	Var.			X	X		X	X
6	"Something Useless"	4-6	Less		X				X	
7	"Toys - How Many Do We <u>Need</u> ?"	4-6	Sev.		X	X	X	X	X	

Sev. = Several Sessions
Var. = Variable
Less = Less than 5 minutes

INDEX
ACTIVITY/SUBJECT MATTER MATRIX
USES (4-6) (continued)

Activity #	ACTIVITY TITLE	Grade Level	Time In 30 Min. Class Per.	SUBJECT MATTER AREAS					
				Math	Lang. Arts	Science	Soc. Studies	Art	Career Aware- ness
8	"What Was It Like Back Then?"	5	2		X		X		X
9	"Our Leisure Time Activities"	4-6	1-2				X		X
10	"Things I Like To Do"	4-6	1				X		X
11	"Imagine - Energy of The Future!"	5	5		X	X		X	X
12	"The Past: You Are There!"	5	Sev.		X	X	X		X
13	"A Trip To Disneyland"	5-6	2	X					X
14	"Industry vs. Environment - Who Wins?"	5	4		X	X	X		X

Sev. = Several sessions

INDEX
ACTIVITY/SUBJECT MATTER MATRIX
USES (4-6) (continued)

Activity #	ACTIVITY TITLE	Grade Level	Time In 30 Min. Class Per.	SUBJECT MATTER AREAS					
				Math	Lang. Arts	Science	Soc. Studies	Art	Career Aware- ness
15	"Six Life Roles and a Mini-Community"	4-6	Sev. weeks	X	X	X	X	X	X
16	"Subject and Predicate Cards 'Mix and Match'"	4-6	1		X				X
17	"People and Energy Keep the World 'Ticking' At Night"	5	5		X		X	X	X
18	"Energy Technology Through The Ages"	5-6	3			X	X	X	X
19	"Clothing - Made of Oil Products?!"	5-6	Sev.		X	X			X

Sev. = Several sessions

INDEX
ACTIVITY/SUBJECT MATTER MATRIX
CONVERSION (4-6)

Activity #	ACTIVITY TITLE	Grade Level	Time In 30 Min. Class Per.	SUBJECT MATTER AREAS						
				Math	Lang. Arts	Science	Soc. Studies	Art	Career Aware- ness	
1	"Light Energy to Heat Energy"	5-6	1			X			X	
2	"Water to Electricity"	5-6	3	X					X	
3	"My Radiometer"	5-6	1			X			X	
4	"Hot Dog!!"	4-5	6			X		X	X	
5	"Wet - Windy and Steamy"	4-5	Sev.			X		X	X	
6	"Password"	6	Var.		X				X	
7	"Elements of A Good Life"	5-6	5				X		X	

Var. = Variable

Sev. = Several sessions

INDEX
ACTIVITY/SUBJECT MATTER MATRIX

CONVERSIONS (4-6) (continued)

Activity #	ACTIVITY TITLE	Grade Level	Time In 30 Min. Class Per.	SUBJECT MATTER AREAS						
				Math	Lang. Arts	Science	Soc. Studies	Art	Career Aware- ness	
8	"What Makes You Happy"	5-6	4				X	X	X	
9	"Solar Collectors"	6	Sev.			X		X	X	

Sev. = Several sessions

INDEX
ACTIVITY/SUBJECT MATTER MATRIX
IMPACTS (4-6)

Activity #	ACTIVITY TITLE	Grade Level	Time In 30 Min. Class Per.	SUBJECT MATTER AREAS						
				Math	Lang. Arts	Science	Soc. Studies	Art	Career Aware- ness	
1	"The Automobile"	5-6	Sev.	X		X			X	
2	"The Air Yells 'Help!'"	5-6	Sev.			X	X		X	
3	"To Fertilize or Not To Fertilize - That Is The Question"	4-5	Sev.			X			X	
4	"Take A Field Trip"	6	2				X		X	
5	"The Kool-Aid Stand"	4-5	4	X	X	X	X	X	X	
6	"Waste Paper Study"	4-5	Less	X					X	
7	"You and Your Environment"	5	Sev.	X	X	X	X		X	

Sev. = Several sessions
Less = Less than 10 minutes

INDEX
ACTIVITY/SUBJECT MATTER MATRIX
IMPACTS (4-6) (continued)

Activity #	ACTIVITY TITLE	Grade Level	Time In 30 Min. Class Per.	SUBJECT MATTER AREAS						
				Math	Lang. Arts	Science	Soc. Studies	Art	Career Aware- ness	Health
8	"Meter Reading"	6	4	X					X	
9	"A Trip To A Factory"	5	Var.				X		X	
10	"Trains or Trucks"	4-5	Var.	X			X		X	
11	"The Last Frontier"	4-5	Sev.	X			X	X	X	
12	"Bagasse"	5-6	5			X	X	X	X	
13	"Starting A Business"	6	4		X		X	X	X	
14	"Simulated Community"	4-6	Sev. days	X		X	X	X	X	

Var. = Variable
Sev. = Several sessions

INDEX
 ACTIVITY/SUBJECT MATTER MATRIX
 IMPACTS (4-6) (continued)

Activity #	ACTIVITY TITLE	Grade Level	Time In 30 Min. Class Per.	SUBJECT MATTER AREAS						
				Math	Lang. Arts	Science	Soc. Studies	Art	Career Aware- ness	
15	"This Land Is My Land!!"	5-6	4				X	X	X	
16	"In The Year 2500?"	5-6	6		X		X	X	X	
17	"Land Pollution"	5-6	Sev.		X	X	X		X	
18	"Water Pollution"	5-6	Sev.		X		X		X	

Sev. = Several sessions

INDEX
ACTIVITY/SUBJECT MATTER MATRIX
LIMITS (4-6)

Activity #	ACTIVITY TITLE	Grade Level	Time In 30 Min. Class Per.	SUBJECT MATTER AREAS						
				Math	Lang. Arts	Science	Soc. Studies	Art	Career Aware- ness	
1	"Search For Minerals"	5-6	8			X	X		X	
2	"What Is A Natural System?"	4-5	Sev.			X			X	
3	"The Word 'Limited'"	4-5	3		X		X		X	
4	"Conservation Begins With You!"	4-5	25		X	X			X	
5	"A Happy Ending"	4-5	2		X				X	
6	"An Old-Fashioned School Day"	5-6	12			X	X		X	
7	"Times Are Changing"	4-5	6				X		X	

Sev. = Several sessions

INDEX
ACTIVITY/SUBJECT MATTER MATRIX
FUTURE (4-6)

Activity #	ACTIVITY TITLE	Grade Level	Time In 30 Min. Class Per.	SUBJECT MATTER AREAS						
				Math	Lang. Arts	Science	Soc. Studies	Art	Career Aware- ness	
1	"Will It Change Our Lifestyle?"	4-6	7		X	X	X	X	X	
2	"New Energy Sources"	4-6	15			X			X	
3	"The Choice Is Yours"	5-6	2			X			X	
4	"An Artistic Creation!"	5-6	4					X	X	

SOURCES OF ENERGY

GOAL :

IT IS ESSENTIAL THAT EACH
PERSON KNOW THAT THERE ARE
MANY SOURCES OF ENERGY.



ACTIVITY
DESCRIPTION PAGE
SOURCES (4-6)

Goal: It is essential that each person know that there are many sources of energy.

Concept: All industrial processes make use of several forms of energy.

Activity #1 "Energy Sources and Measurements"
Grade level 6 Time: 2 - 30 minute
Language Arts sessions
Given a crossword puzzle to complete, the student will become familiar with a variety of energy sources and some terms used to measure energy.

Concept: Natural processes are constantly forming and concentrating fossil fuels, but at a rate much slower than these sources are being used.

Activity #2 "Some Things are Renewable and Others are Not"
Grade level 4-5 Time: 3 - 30 minute
Science sessions
Given the opportunity, the student will be able to describe ways that some of our resources, material or energy, can be renewed easily and quickly while others cannot.

Concept: Access to energy sources affects the growth of differing technological, social, governmental, economic and cultural systems.

Activity #3 "Sources of Energy From Past to Present"
Grade level 5-6 Time: 12 - 30 minute
Science, Social Studies, Art sessions
Given the opportunity, the student will identify ways that technologically advanced societies have developed more sources of energy than primitive societies.

Concept: Most specific forms of energy originated with the sun.

Activity #4 "Our Mr. Sun"
Grade level 5-6 Time: 4 - 30 minute
Science, Art sessions
Given the opportunity, the student will learn that the sun is an energy source and is the original source of all of our energy.

ACTIVITY
DESCRIPTION PAGE

SOURCES (4-6) (continued)

SOURCES

- Activity #5** "Energy From The Sun"
Grade level 5-6 Time: 2 - 30 minute
Science sessions
Given the opportunity, the student will demonstrate how different materials either reflect or absorb solar radiation by means of experiments.
- Concept:** Energy sources are unevenly distributed around the earth.
- Activity #6** "Drawing Relay"
Grade level 5-6 Time: 1 - 30 minute
Language Arts, Art session
Given the opportunity to participate in a drawing relay, the student will be able to identify energy sources.
- Activity #7** "Windmills, Kites, and Gliders"
Grade level 4-6 Time: 18 - 30 minute
Art, Science sessions
Given the opportunity, the student will be able to name and explain at least three different ways in which wind may be used as a power source.
- Activity #8** "Questioning 'Yes or No?'"
Grade level 4-6 Time: 1 - 30 minute
Language Arts session
Given the opportunity, the student will be able to use the inquiry process as one technique for obtaining data about energy sources.

title: "Energy Sources and Measurements"



sources



concept: All industrial processes make use of several forms of energy.

objective: Given a crossword puzzle to complete, the student will become familiar with a variety of energy sources and some terms used to measure energy.

time: 2 - 30 minute sessions

subject matter area: Language Arts

grade: 6

implementation:

- Activity:**
1. The clues are to be used with the attached crossword puzzle entitled "Energy Sources and Measurements."
 2. The words used in the crossword puzzle are listed at the bottom of the handout sheet and may be detached or left on as needed by the particular student.
 3. Have the students complete the puzzle and then correct in class together.

Optional Activity: Have the students make their own puzzle for others to try.

SUGGESTED CAREER AWARENESS ACTIVITY:

If your local newspaper includes a crossword puzzle, have the author come to class to explain the "in and outs" of constructing a puzzle.

materials:

Student handouts (attached)



SUGGESTED ASSESSMENT PROCEDURE:

Given a crossword puzzle to complete, the student will be able to list several forms of energy.

Developed by: LaVon Bucher
Kirkland School District
Kirkland, WA

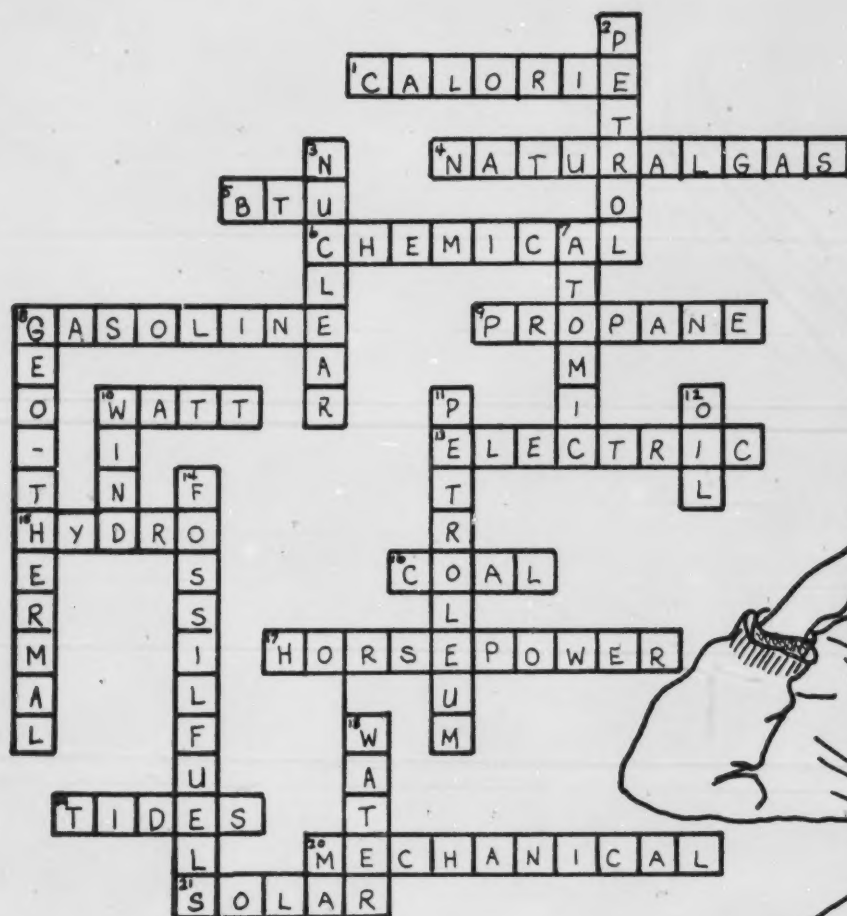
Revised by: Dan Grimes, EME



activities



Solution to Energy Sources & Measurements Crossword Puzzle





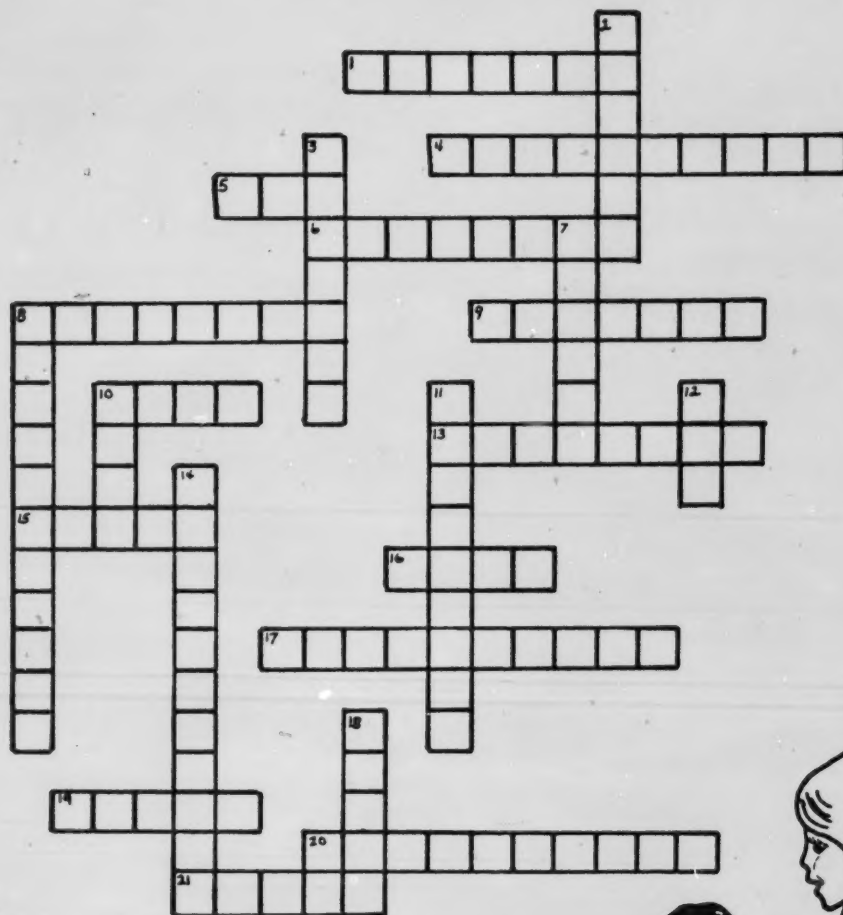
activities



SOURCES

Energy Sources & Measurements

Crossword Puzzle





activities



Clues to Crossword Puzzle on Energy Sources & Measurement

ACROSS:

1. Unit used to express the energy value of food.
4. Combustible gas formed naturally in the earth (two words).
5. Abbreviation for British thermal unit.
6. Kind of energy which is stored in a battery.
8. Fuel used in many internal-combustion engines.
9. Gas which is often bottled and used to operate stoves.
10. Unit used to measure the power of electrical energy.
13. Energy created when the magnetic lines of force are broken by mechanical means as in a generator.
15. A word meaning water.
16. Black or dark-brown mineral used as fuel.
17. Unit used to measure power of an automobile.
19. Periodic rise and fall of the ocean's water.
20. Kind of energy produced by machinery.
21. Most widespread source of energy.

DOWN:

2. British term for gasoline.
3. Energy form as old as the earth which was not used by man until this century.
7. Energy obtained from changes within the atomic structure of certain elements.
8. Energy produced by heat from within the earth (hyphenated).
10. A source of energy produced by air in natural motion.
11. A dark, oily liquid used as a fuel and usually obtained by drilling.
12. A combustible liquid used for cooking and heating - not soluble in water.
14. Fuels which are made of plant and animal remains and which are usually obtained by digging.
18. A transparent, odorless liquid used as an energy source.

WORDS USED:

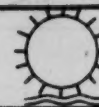
atomic
BTU
calories
chemical
coal
electric
fossil fuels
gasoline
geothermal
horsepower
hydro

mechanical
natural gas
nuclear
oil
petrol
petroleum
propane
solar
tides
water
watt

title: "Some Things are Renewable and Others are Not"



sources



concept: Natural processes are constantly forming and concentrating fossil fuels, but at a rate much slower than these sources are being used.

objective: Given the opportunity, the student will be able to describe ways that some of our resources, material or energy, can be renewed easily and quickly while others cannot.

time: 3 - 30 minute sessions

subject matter area: Science

grade: 4-5

implementation:

- Activity: 1. Ask the students, "What parts do you have that are renewable?" They might think of hair, nails, skin, blood cells "Have you any parts that are not renewable--that will not be replaced or grow back if you lose them?" They might include a finger, a permanent tooth or other body parts. (Tonsils, and appendix might be suggested; the former regenerate commonly.)
- "Some of your clothes are made from renewable materials. Which do you think would be renewable? Clues: Remember, your hair is renewable (replaces itself)."
 - Get examples of renewable fibers, fabrics or materials used in garments. Renewable materials would include cotton, wool, silk, leather. Nonrenewable would include nylon, orlon, rayon, plastic (as in buttons, zippers), polyester, other manmade fabrics. Have students examine what they are wearing presently to help recall the varieties possible.
 - Are the foods you eat renewable or nonrenewable? (Note: Our foods are produced by living things and are therefore renewable.)

materials:



Natural fibers, fabrics and materials used in garments

Synthetic materials



implementation:

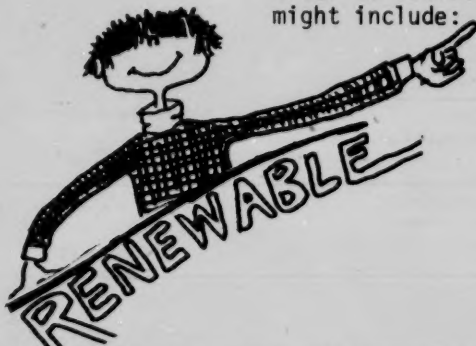


Activities: 2. Homework assignment: Have students bring to class examples of materials that are renewable. Some things should present problems in classifying; for example metals or glass which can be melted and reused may be considered renewable, but they are being used again rather than replaced.

a. Examine the materials brought in by the classes and determine the categories in which they fall.

3. Then, having established what is meant by "renewable" and "nonrenewable," point out that these terms may apply to energy as well as to materials. List energy sources on the board and have the class decide which belong in each of the two categories. Students may need to look up information in reference books in order to decide on the category. Energy sources might include:

- Sun
- Oil
- Coal
- Natural gas
- Nuclear fuel (uranium)
- Wind
- Tide
- Refuse (garbage)
- Food
- Ocean currents
- Falling water
- Geothermal



SUGGESTED CAREER AWARENESS ACTIVITY:

Invite speakers who work in a field related to a renewable source, and a non-renewable source of energy to speak with the class about his/her job.

materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given a list of resources, the student will be able to classify those that are renewable and nonrenewable.



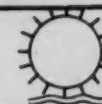
Developed by: Lois Helton
Beaverton School Dist.
Beaverton, OR

Revised by: Dan Grimes
EME

title: "Sources of Energy From Past to Present"



sources



concept: Access to energy sources affects the growth of differing technological, social, governmental, economic and cultural systems.

objective: Given the opportunity, the student will identify ways that technologically advanced societies have developed more sources of energy than primitive societies.

time: 12 - 30 minute sessions

subject matter area: Science, Social Studies, Art.

grade: 5-6

implementation:

- Activity:
1. Have the students research the many sources of energy used from the time of early humans to the present. This information should then be developed into a mural.
 2. Have the students keep the following questions in mind to guide them in their research: (Possible answers follow each question.)
 - a. What sources of power were used by early humans?
 - Early people used their muscles, flowing water, eventually used fire.
 - b. Why did people start out using these simple power sources rather than something more complex?
 - Early humans lacked the knowledge to use more complex sources of energy and therefore used that which was readily available to them.
 - c. As people began using animals to lighten their work load, what happened?
 - As animals lightened the human work load, people had more time to develop their knowledge.

materials:



Butcher paper and crayons or paints for mural.
 Chart on Energy Use Comparisons, attached.
 Books from library for research.
 May want to order films and/or filmstrips available on the subject.



implementation:



Activities: (cont.)

- d. As human knowledge in the areas of writing, mathematics, astronomy, geography, architecture and metallurgy increased, what resulted?
 - As human knowledge increased, people gained the skills and ability to develop and use more sophisticated power sources (i.e., simple machines such as the wheel, gears, inclined plane, wedge, lever, siphon and pump).
- e. How did the development and use of new power sources lead to the harnessing of even more sophisticated power sources?
 - The new tools or technological developments could be used to extract and develop even more sophisticated energy sources. For example, the Newcomen steam engine was first used as a pump to drain water from a deep tin mine in England, thus making the tin available. However, it was half a century later before steam power was introduced to industry.
- f. The class might be interested in doing some research on steam engines at this point.
- g. What are some of the energy sources that we now use everyday?
 - Everyday energy sources we use are electricity, gasoline, oil, wood, coal, and nuclear power, to mention just a few.
- h. What are some of the new energy sources we are now developing and putting to use?
 - Some of the "new" sources which we are starting to use really aren't so new, but we are really just starting to develop some of them such as solar power, geothermal power, wind power, nuclear power.

materials:



implementation:



Activities: (cont.)

- i. Compare the number of energy sources and the amount of energy being used in the United States with a less technologically advanced country such as those in South America or Africa. Would you say that a technologically advanced society used more or less energy? Why?
 - See the enclosed chart for comparisons of energy consumption in several countries.
 - Technologically advanced societies use more energy from more energy sources because they have the know-how, the money, and the equipment to develop sites to make more energy available, just as the steam engine was used to pump water to make tin available in question and answer "e."

SUGGESTED CAREER AWARENESS ACTIVITY:

Students may research and report on the development of various careers created by increased use of technology. This study would cover careers evolving from the industrial revolution up through the present.

materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity to complete research, and answer and discuss questions contained in the learning package, the student should be able to meet the stated objectives.

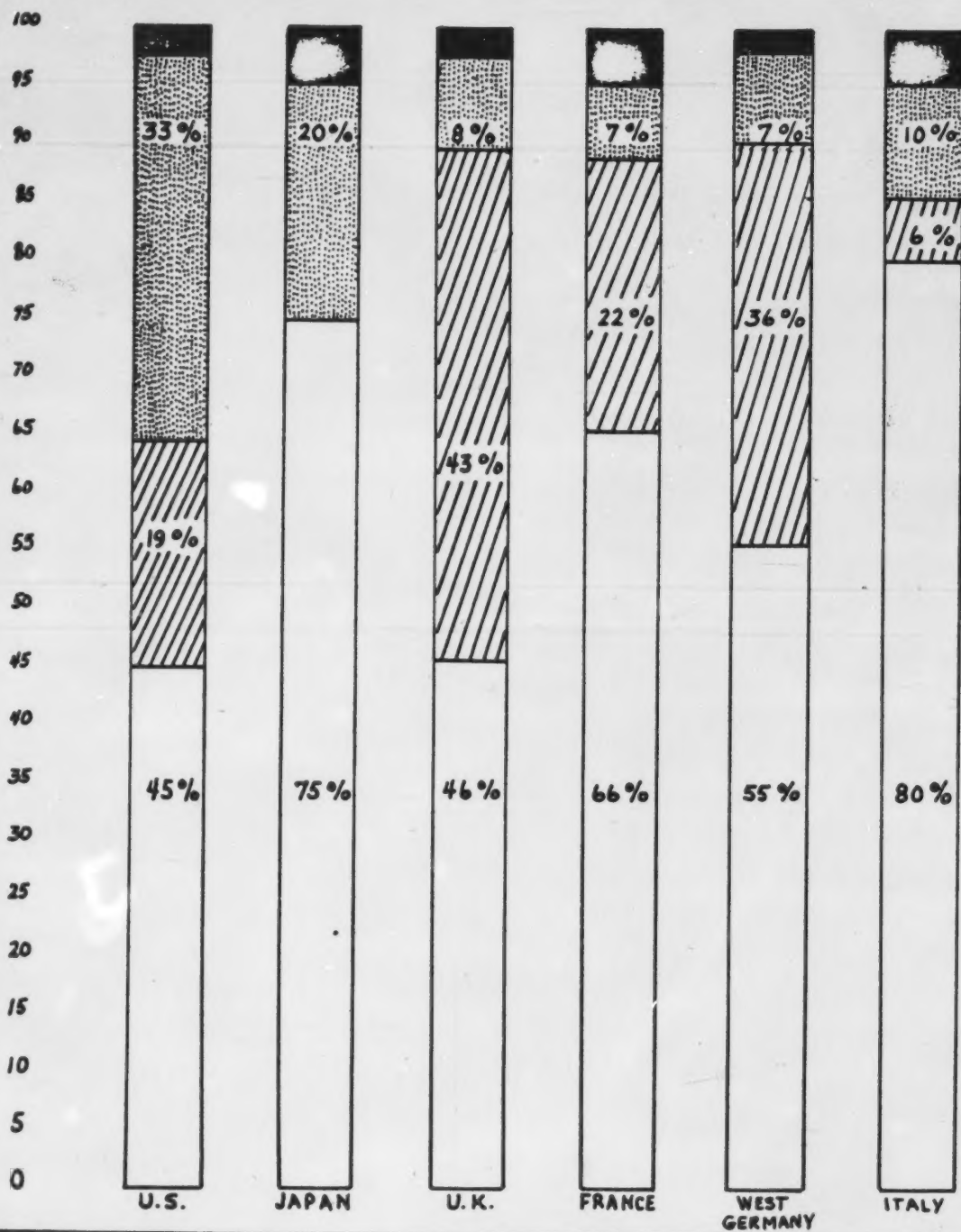
Developed by: Shirley Barnes
Beaverton School Dist
Beaverton, OR

Revised by: Dan Grimes
EME

42



activities



SOLID FUEL



OIL



OTHER



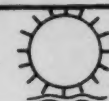
NATURAL GAS

Share of Energy Sources in Total Primary Energy Requirements, 1971

title: "Our Mr. Sun"



sources



concept: Most specific forms of energy originated with the sun.

objective: Given the opportunity, the student will learn that the sun is an energy source and is the original source of all of our energy.

time: 4 - 30 minute sessions

subject matter area: Science, Art

grade: 5-6

implementation:

- Activity:
1. Show the film, "Our Mr. Sun, Parts I and II."
 - a. Discuss the importance of the sun and the fact that all life on earth depends on the sun. It is our original source of heat and light energy.
 2. The following activities may be used to help students understand that the sun is the original source of all energy.
 - a. Have the students research how the sun affects the formation or availability of these energy sources. This information could then be illustrated in a mural made by the class.
 - b. Have the students list the various energy sources we now use.
 - c. As examples of energy sources and their relationship to the sun, the students might list:

Energy Source	Relationship to Sun
Fossil fuels (Oil, Gas Coal, etc.)	Fossil fuels are formed from decayed plants and animals. Plants get their food through photosynthesis (see the enclosed chart explaining photosynthesis). In turn, animals eat plants

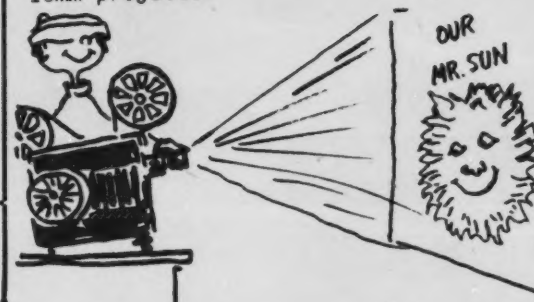
materials:

Photosynthesis chart (included)
Experiment for solar water heater (enclosed). Materials are listed on enclosure.

Film:
"Our Mr. Sun, Parts I and II," 30 minutes each, color, Wave, Bell Telephone System, Science 1956.

equipment:

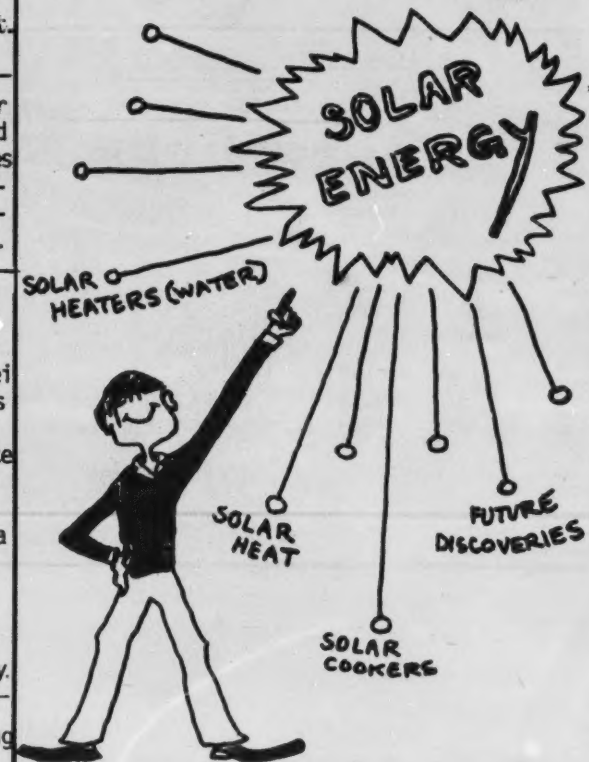
16mm projector



implementation:Activities:
(cont.)

Energy Source	Relationship to Sun
	or other animals. Both plants and animals need the warmth of the sun.
Geothermal energy	Geothermal energy is the earth's heat.
Water power such as hydropower	We need rain in order to have a water supply. Without the sun, there would be no water cycle. The sun evaporates water from the earth, the earth condenses, clouds are formed and precipitation in turn falls from the clouds.
Nuclear	The cyclotron, or "Atomic Gun," is used to speed up and release the nuclei of hydrogen atoms or the nuclei of helium atoms and split other atoms (fission). The cyclotron needs electrical charges in order to operate. This takes us back to the sun as the original energy source. Of course, without the sun, the Earth would be a dead, frozen planet anyway. Also, the sun itself is a huge nuclear furnace, depending on fusion to produce its own heat and light energy.

3. Solar energy (the sun's heat and light energy) is being used to do work for us. Some examples are:
- Houses are being built to use solar heat.
 - Solar cookers.
 - Solar heaters (See the enclosed directions for an experiment demonstrating the basic principle of a solar heater).

materials:

implementation:



Activities: Optional activities: Have the students think of other uses (cont.) for solar energy.

SUGGESTED CAREER AWARENESS ACTIVITY:

Role-play being a solar engineer who has the job of inventing new things that use solar energy.



materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity to complete a mural and do an experiment, the student will be able to demonstrate an understanding of the sun as a source of energy.

Developed by: Shirley E. Barnes
Beaverton School District
Beaverton, OR

Revised by: Dan Grimes
EME



activities

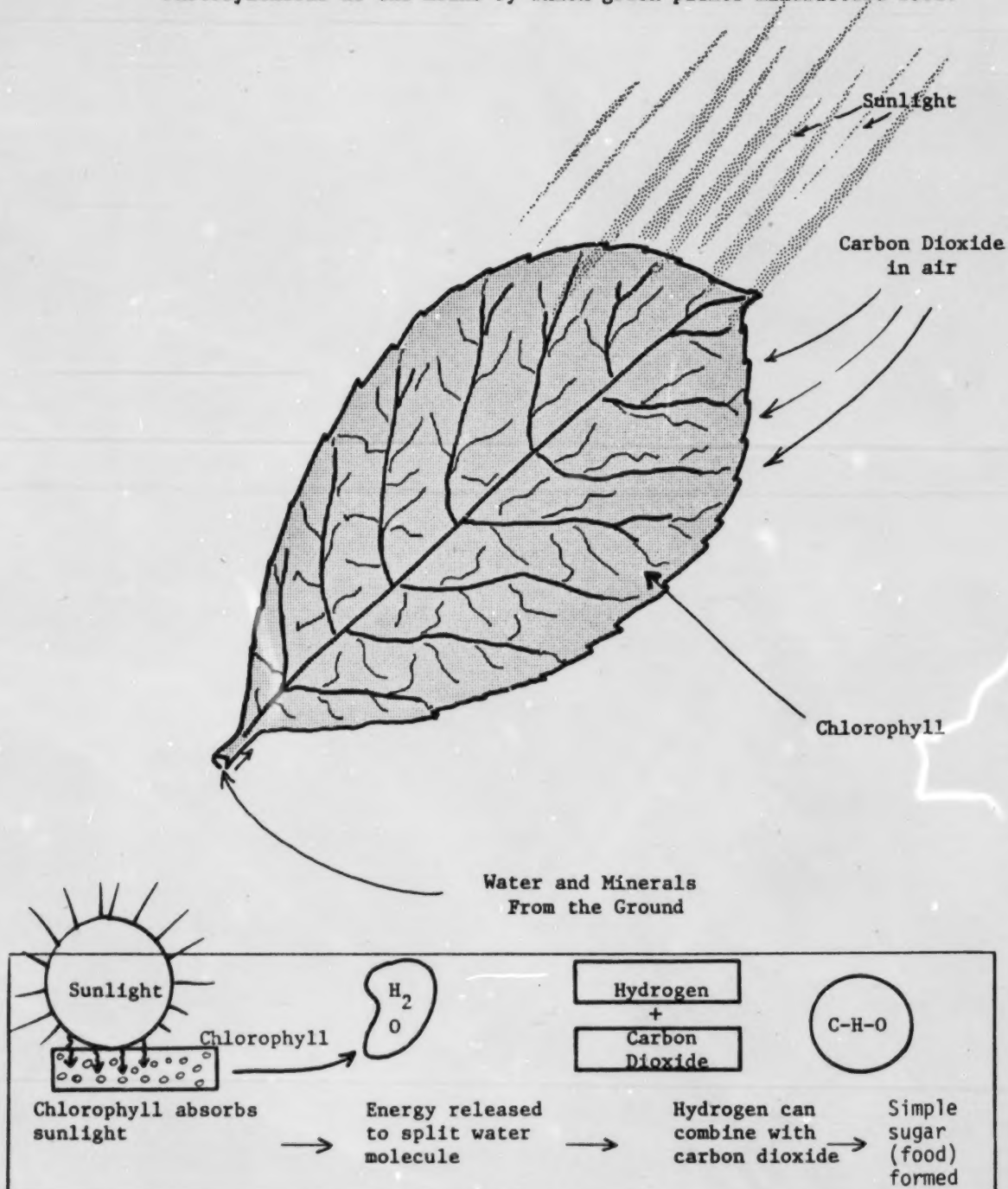


Sunlight - yellow
Chlorophyll - green
Leaf - green

Transparency

PHOTOSYNTHESIS

Photosynthesis is the means by which green plants manufacture food.





activities



PLANS FOR EXPERIMENT ON SOLAR HEATER

Materials needed:

1. Two picture frames approximately 8"x10" or smaller, with the glass included.
2. Four pieces of black rubber tubing, each approximately 8" long and four pieces of light-colored rubber tubing. (Fingers from an old rubber glove could be used instead of tubing if tubing is not available.)
3. One piece black construction paper.
4. Lamp, such as a study lamp, which is flexible, so that it can shine directly down on the table. The lamp should have a 100-watt bulb.
5. A small water pitcher filled with water at about room temperature.
6. Thermometer
7. Scissors

Procedure:

1. Cut the black construction paper to fit the picture frame.
2. Insert the construction paper on top of the glass in the picture frame.
3. Remove the cardboard back, but not the glass, in the second picture frame, invert the frame, and place it over the first frame, which is lying on the table, in order to form an air chamber between the frames.
4. Tie knots in one end of each of the rubber tubes.
5. Fill the tubes about 3/4 of the way with water from the water pitcher and tie off the remaining ends so that the water is trapped inside.
6. Place a light- and a dark-colored, water-filled tube on the table next to the picture frame (solar heater).
7. Next, remove the top picture frame placing a light- and dark-colored, water-filled tube inside, on top of the construction paper, about 5" from the edge.
8. Then replace the top frame and place a light- and a dark-colored tube on top of the glass. (Place the tubes next to but do not cover the tubes under the glass.)
9. Finally, place a light and a dark water-filled tube a few feet away from the solar heater to serve as control specimens.
10. Place study lamp (sun) over the six specimens which are lying side by side, and direct the lamp (sun) so that all six specimens receive the maximum light intensity of about the same amount. The lamp should be about 10" above the specimens.



activities



Plans for Experiment on Solar Heater (Continued)

11. Allow approximately 45 minutes for the specimens to be exposed to the lamp or "sun."
12. While the specimens are heating up, the students may make the following chart:

Tubing	Control	Outside the heater	On heater	In heater
Light				
Dark				

After sufficient time, starting with the control specimen, cut the end of the tubing off, insert the thermometer, and record the temperature on the chart.

Next, repeat the procedure with the tubes outside heater, then the tubes on the heater, and finally, the tubes inside the heater.

If enough thermometers and space are available, eight groups of students may wish to participate in taking the readings.

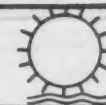
Principle:

The sun's heat may be captured and used before it dissipates. Protected by sheets of glass, water is pumped over a black surface and/or through black pipes. The dark color absorbs much heat and transfers it to the water. The glass prevents the heat from radiating into the air. The heated water is pumped into tanks where the heat is exchanged into a heating system or hot water storage tanks.

title: "Energy From The Sun"



sources



concept: Most specific forms of energy originated with the sun.

objective: Given the opportunity, the student will demonstrate how different materials either reflect or absorb solar radiation by means of experiments.

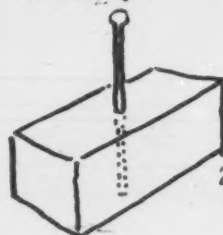
time: 2 - 30 minute sessions

subject matter area: Science

grade: 5-6

implementation:

Activity:

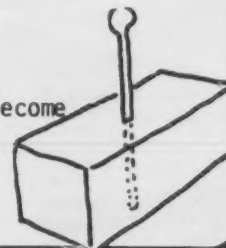


1. The students are asked to line two boxes of similar size with different coverings. One box should be covered with black paper and the other box should be covered with aluminum foil, as described on the drawing. A thermometer is placed in each box and a comparison is made of the different temperatures.
2. This could be extended by using different colors and different textures of covering and lining materials.
3. Construct similar size boxes as shown. Expose both boxes to sunshine equally and note temperature inside the boxes.

Optional Activities: Line box with black paper and cover with black paper.
Line box with aluminum foil and cover with aluminum foil.

SUGGESTED CAREER AWARENESS ACTIVITY:

Ask students to suggest jobs that could result if we were to become dependent upon solar energy.



materials:



Boxes
Thermometers
Black paper and possible other colors.
Aluminum foil

SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, to complete the activities, the student will be able to explain the effect of the different coverings on the temperature of each box.

Developed by: Ed Walters
Eugene, OR

Revised by: Dan Grimes, EME

title: "Drawing Relay"



sources



concept: Energy sources are unevenly distributed around the earth.

objective: Given the opportunity to participate in a drawing relay, the student will be able to identify energy sources.

time: 1 - 30 minute session

subject matter area: Language Arts, Art

grade: 5-6

implementation:

1. Arrange the students in groups of five, having them sit on the floor or at tables in various locations in the room.
2. Place one pencil and some paper in the center of each circle.
3. Number the students in each circle from 1 to 5. Seat yourself as far away from the circles of students as you can.
4. When the signal is given, the first student from each circle comes to you. He/she is to come without pencil or paper.
5. Tell each one the name of the first item on the list. (See list provided)
6. Each student returns to their respective circles, takes the pencil in the center and draws (without talking) the item until someone in the circle identifies it, using a soft voice.
7. The second person in the circle comes to you and tells you what the group has determined the drawing is.
8. You then give that student a new object to draw.
9. A sample list of items or object follows:

materials:



Construction paper (several sheets)
Pencils
List of energy sources



implementation:



(cont.)

Sun
Steam
Wood
Apple
Wind

Factory Smoke
Trash Collector
Dam
Plant

10. Remind the students that if they yell out what is being drawn, others will hear.

Optional activities: The teacher can make up his/her own list of words for different subjects.

SUGGESTED CAREER AWARENESS ACTIVITY:

Have the students draw a picture of a person working with one of the energy sources used in the activity.

materials:



SUGGESTED ASSESSMENT PROCEDURE:

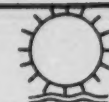
Given the opportunity to participate in a drawing relay, the student will be able to make a picture of an energy source that others can identify.

Developed by: Dan Grimes
EME

title: "Windmills, Kites, and Gliders"



sources



concept: Energy resources are unevenly distributed around the earth.

objective: Given the opportunity, the student will be able to name and explain at least three different ways in which wind may be used as a power source.

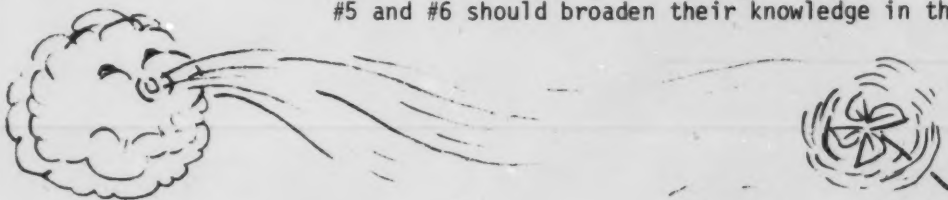
time: 18 - 30 minute sessions

subject matter area: Art, Science

grade: 4-6

implementation:

- Activity:
1. Introduce the idea of using sources other than water to produce energy. List the students' ideas on the board and discuss them.
 2. Wind power should be one of the possibilities listed. Tell the class that our project will involve the study of wind power as an energy source.
 3. Discuss the various things for which wind power may be used. Some examples might include:
Windmills
Gliders
Kites, etc.
 4. The students should be able to tell some of the advantages and disadvantages of using wind power. (Activities #5 and #6 should broaden their knowledge in this area.)



materials:



Materials needed to construct windmill prototype. (Instructions for this project are attached.)

Used papers to make glider models.

The Great International Paper Airplane Book, Jerry Mander, George Dippel, and Howard Gossage: Simon & Schuster, NY, 1967.

equipment:

Materials listed with windmill project.



Implementation:**Activities:**
(cont.)

Examples of advantages and disadvantages of wind power:

Advantages

- a. Clean energy source
- b. Unlimited supply
- c. Cheap

Disadvantages

- a. Need at least 10 mph wind
- b. Wind speed varies greatly over short distances
- c. When using a windmill, it must be positioned so that the wind source is not blocked.

- 5. Show and discuss available films on wind power.
- 6. Have the class research and become involved in projects on how wind power might be used. As a follow-up of #3 above, some possible projects related to wind power are listed here:
 - A. Windmills
 - 1. Research the construction and use of windmills. Through their research, students should become aware of the fact that windmills are used for various purposes (i.e. windmills can be used to generate electricity or to grind flour). Students could diagram and label windmills and their various purposes for a bulletin board display.
 - 2. Show available films and filmstrips.
 - 3. If possible, visit the site of a windmill.
 - 4. Build a prototype of a windmill. Plans for this project are included. (When testing your windmill, an electric fan may be used to supply the "wind" if it isn't windy enough outside.)
 - B. Gliders
 - 1. Have the students do research on gliders.
 - 2. Show available films and filmstrips.

materials:

implementation:



Activities: (cont.)

3. Have the students design and construct their own model gliders out of paper. (Paper could be obtained by using old assignment papers, old math papers, etc.)
4. Have a class contest out on the playground to see whose glider can stay up the longest and whose can travel the farthest. Why does one stay up longer or travel further than another?

C. Kites

1. Study the history of kites.
2. Have interested students make and fly their own kites.

7. Extra Credit

Have the students think of new or different ways in which wind power could be "harnessed." Have the students make designs of their ideas and build prototypes if possible.

SUGGESTED CAREER AWARENESS ACTIVITY:

Invite a person who has had experience with planes to class to explain wind as a source of energy when flying. Have the students interview him/her in regard to what it is like to be a pilot.

materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity to do the class activities on wind power, the student should be able to demonstrate a knowledge of at least three different ways in which wind may be used as a power source, and to list the advantages and disadvantages of wind power.



Developed by: Shirley E. Barnes
Beaverton School District
Beaverton, OR

Revised by: Dan Grimes
EME

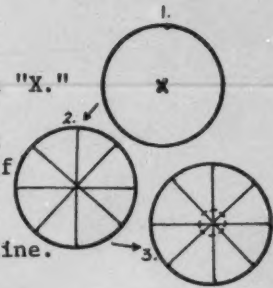
INSTRUCTIONS FOR MAKING A PROTOTYPE WINDMILL

Materials needed:

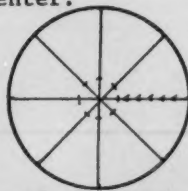
- Standard 9" diameter paper plate
- 2 - empty wooden sewing spools
- New 6-sided, sharpened pencil
- 4 - pieces of scotch tape, about 5" long
- Spring-type clothes pin
- 4"-5" cylinder, 1/4" to 3/8" diameter, such as a 1/2" plastic hose connector
- 1 - ruler
- Pencil for marking

Procedure:

1. Find center of paper plate with ruler and mark with an "X."
2. Divide the plate into 8 parts with the ruler, by first dividing the plate in half one way, then divide in half the other way. Finally, halve the quarters.
3. Measure out from center 3/4" and make a mark on each line.
4. With scissors, cut from outside edges along marked lines to the mark 3/4" from the center.



5. Carefully fold each flap toward the center so that the bottom edge of the flap falls across the mark in the center. (Pull each flap back after folding.)
6. When all flaps have been creased and pulled back, carefully refold one at a time as you go around the plate. The last three flaps can be worked in by keeping the first five loose.
7. By slightly reopening the flower petal-like arrangement, the end of a wooden sewing spool can be inserted into the center. When the spool is in, place the plate on the table and press down on the flaps so that they are nearly flat on the table around the spool.
8. Place the center of a piece of scotch tape about 5" long on top of the spool and attach the ends to the two flaps opposite each other, being careful not to tape the two flaps together. Repeat with the three other opposing sets of flaps.
9. Push the second spool (the one not attached to the plate) onto the pencil, almost down to the eraser end. This will be the gear or driving pulley.
10. Insert the pencil into the cylinder.
11. Insert the pencil point through the tape into the windmill.



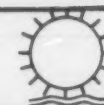
Cut along line to 3/4" mark. Do this to all 8 lines.



title: "Questioning 'Yes or No?'"



sources



concept: Energy sources are unevenly distributed around the earth.

objective: Given the opportunity, the student will be able to use the inquiry process as one technique for obtaining data about energy sources.

time: 1 - 30 minute session

subject matter area: Language Arts

grade: 4-6

implementation:

Statement:

This activity can be adapted to any grade level. The process of the activity is the major focus and should be carried out at least three times a week. As students become more skillful, try colors, concepts, words that define concepts, tools, behaviors, feelings, etc.

Procedure:

On 3 x 5 cards, write the following energy sources. (One on each card.)

- | | |
|------------------|-----------------|
| 1. Coal | 8. Geothermal |
| 2. Oil | 9. Hydro |
| 3. Sun | 10. Natural Gas |
| 4. Gasoline | 11. Garbage |
| 5. Wood | 12. Wind |
| 6. Nuclear | 13. Plants |
| 7. Ocean Current | |

You can duplicate each source of energy to have enough for a class size of 26.

Note:

For lower grades: Preview the list of sources and discuss with students before beginning the activity.

materials:

1 felt pen
3 x 5 cards



Implementation:



(continued)

20 minutes:

Explain the rules of the simulation.

-You may ask questions.

-You may ask only 3 questions per person.

-Questions can be answered with only yes or no.

-Place the cards on backs of everyone in the room and allow them to ask their questions. If anyone identified their energy source, they are to continue to answer questions for the others.

-If a person has identified their card, then you take it

-Questions can be answered with only yes or no.

15 minutes:

After 20-30 minutes, stop the activity and have the students place their cards on the front. Then have them group themselves according to similar energy source. Have each group define why they have grouped themselves in that particular group.

5 minutes:

Finalize lesson by answering questions the students may have on how to ask questions to get data for new questions. Prepare them for the session the next day.

Optional Activities: Determine those energy sources that are not located in your local area.

SUGGESTED CAREER AWARENESS ACTIVITY:

As a class, list the energy sources used in your local area and name two occupations that work directly with that source. (e.g.: coal=coal miner)

materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity to use inquiry skills, the student will be able to determine the source of energy he/she is trying to find out about.

Developed by: Dan Grimes
EME

USES OF ENERGY

GOAL:

IT IS ESSENTIAL THAT EACH
PERSON KNOW THAT PEOPLE ARE
DEPENDENT UPON ENERGY.



ACTIVITY
DESCRIPTION PAGE
USES (4-6)

- Goal:** It is essential that each person know that people are dependent upon energy.
- Concept:** There are many ways to conserve energy.
- Activity #1** "I Can Reduce My Use"
Grade level 5-6 Time: 2 - 30 minute
Social Studies (values and decision sessions
making), Mathematics
Given the opportunity, the student will identify ways in which he/she can conserve energy at home, school, and in the broader community.
- Activity #2** "Paper, Paper, Paper, - Let's Conserve!"
Grade level 4-6 Time: Several sessions
All Subject Matter Areas
Given the opportunity, the student will be able to practice conservation techniques after assessing the amount of paper products he/she uses daily.
- Activity #3** "Am I Energy-Wise?"
Grade level 5 Time: 2 - 30 minute
Science, Language Arts sessions
Given the opportunity, the students will learn the many ways they make use of energy and ways they might conserve it by keeping a detailed personal record.
- Activity #4** "The Last Three"
Grade level 5-6 Time: 1 - 30 minute
Science, Language Arts session
Given the opportunity, the student will consider uses of electricity around the home in order to determine which are most or least essential, thus making choices in conservation of energy.
- Activity #5** "Peter and Alice in No-Energy Land"
Grade level 4-5 Time: Varied
Science, Social Studies, Creative Dramatics
1. Given the opportunity, the student will be able to recognize misuse of electrical energy.
2. Given a list of appliances, the student will be able to categorize them as being necessary, somewhat necessary or unnecessary.

ACTIVITY
DESCRIPTION PAGE

USES (4-6)

(continued)

- Activity #6 "Something Useless"
Grade level 4-6 Time: Less than 5 minutes
Language Arts - communication
Given the opportunity, the student will describe ways that "throw-away" products can be re-used or re-cycled.
- Concept: Every decision made involving energy affects standards of living.
- Activity #7 "Toys - How Many Do We Need?"
Grade level 4-6 Time: Several sessions
Science, Social Studies, Art, Language Arts
Given the opportunity, the student will compare his/her use of energy and lifestyle to that of a less technically developed society and consider changes he/she could make in the future.
- Activity #8 "What Was It Like Back Then?"
Grade level 5 Time: 2 - 30 minute sessions
Social Studies, Language Arts
Given the opportunity, the student will be exposed to a different style of growing up as experienced by an older family member or neighbor.
- Activity #9 "Our Leisure Time Activities"
Grade level 4-6 Time: 1-2 30 minute sessions
Social Studies (values) depending on grade level
Given the opportunity to participate in a values clarification exercise, the student will be able to become more aware of the relationship between standard of living and energy use.
- Activity #10 "Things I Like To Do"
Grade level 4-6 Time: 1 - 30 minute session
Social Studies depending on grade level
Given the opportunity to make a list of things they like to do, the students will be able to examine the items and determine a value for each.
- Activity #11 "Imagine - Energy of the Future!"
Grade level 5 Time: 5 - 30 minute sessions
Science, Language Arts, Art
Given the opportunity, the student will be given a "story beginning" to continue and finish with predictions he/she might have. The assignment is not scientifically oriented, its purpose is to start students thinking.

ACTIVITY
DESCRIPTION PAGE
USES (4-6)

(continued)

- Activity #12 "The Past: You Are There!"
Grade level 5 Time: Several sessions
Science, Social Studies,
Language Arts
Given the opportunity, the student will role play, for a day, a person from a different era in the U.S. and research his/her era.
- Concept: Social, economic and political pressures influence the efficient and economical use of energy.
- Activity #13 "A Trip To Disneyland"
Grade level 5-6 Time: 2 - 30 minute
Mathematics sessions
Given the opportunity, the student will evaluate the positive and negative counterbalance of various energy sources.
- Activity #14 "Industry vs. Environment - Who Wins?"
Grade level 5 Time: 4 - 30 minute
Science, Social Studies sessions
Language Arts
Given the opportunity, the students will be placed in a situation where they are either a business person wanting to construct a large coal mine (example), or a conservationist wanting to 'save' the land and animals that inhabit the area in question.
- Activity #15 "Six Life Roles and a Mini-Community"
Grade level 4-6 Time: several weeks
All Subject Matter Areas on-going
Given the opportunity, the student will realize that individuals may band together in citizen groups to affect political/social/economic choice.
- Concept: Each form of energy is used in many ways.
- Activity #16 "Subject and Predicate Cards 'Mix and Match'"
Grade level 4-6 Time: 1 - 30 minute
Language Arts session
Given the opportunity, the student will be able to gain information about energy use by matching subject phrases with predicate phrases.

ACTIVITY
DESCRIPTION PAGE

USES (4-6) (continued)

Activity #17 "People and Energy Keep the World 'Ticking' At Night"
Grade level 5 Time: 5 - 30 minute
sessions

Social Studies, Career Awareness,
Language Arts, Art

Given the opportunity, the student will list all of
the energy uses 'round the clock' and the people who
keep the world 'ticking' at night.

Concept: Some human technologies and activities use more energy
than others.

Activity #18 "Energy Technology Through The Ages:
Grade level 5-6 Time: 3 - 30 minute
sessions

Science, Art, Social Studies

Given the opportunity, the students will be able to
describe human progress related to the harnessing of
different energies through the use of student created
murals.

Concept: All industrial processes make use of several forms of
energy.

Activity #19 "Clothing - Made of Oil Products?!"
Grade level 5-6 Time: Several sessions
Science, Language Arts (creative writing)

Given the opportunity, the student will be able to list
ways through the use of the activities in this unit,
that our society depends upon oil and oil products and
recognize what the effects of a reduction in the use of
oil-based products would have upon us individually.

title: "I Can Reduce My Use"



uses



concept: There are many ways to conserve energy.

objective: Given the opportunity, the student will identify ways in which he/she can conserve energy at home, school, and in the broader community.

time: 2 - 30 minute sessions

subject matter area: Social Studies (values and decision making) Mathematics

grade: 5-6

implementation:

- Activity:
1. Ask each student to list 10 energy using devices that they personally use in their daily living.
 2. Once the list is compiled, ask each student to rank in order each energy using device from the most important to the least important to them (place a 1 next to the most important, a 2 next to the second most important, etc...)
 3. Have each student assign a value of 3 to each device that uses a major amount of energy, assign a value of 2 to the devices that use a moderate amount of energy and a value of 1 next to the items that use very little.
 4. Next have students assign 3 points to each item that they use a great deal, 2 points to each item they use moderately, and 1 point to the items they use very little. Add together and determine the total of "points for my use" and "conservation balance". (see chart)
 5. Discussion:
What have you learned about yourself from the list, the rank ordering, the amount of consumption, and the amount you use each device?

materials:

Pencil and paper
Sample of activity



implementation:



Activities: 6. Can you reduce your use? Have each student begin deciding how they might conserve energy by reducing their use of some or all of the energy devices. Tell the students that a serious energy crisis has come about and all people must reduce the amount of energy they use in their daily living. Or...tell them that you want them to voluntarily reduce their energy consumption and to begin conserving. Or...? At this point, the students should begin subtracting points from the items they personally feel could be used at a reduced rate in their daily living. The object of this task is to see how many would be willing to reduce their overall consumption by 40% or?.... Can anyone do it? Would you be willing to do it? (Why, why not) Proceed with a class discussion concerning conservation of energy.

Optional activities: Have the students begin an individual plan to conserve energy by writing it down on paper, and then by carrying it out. Check with the students periodically to see how they are doing.

SUGGESTED CAREER AWARENESS ACTIVITY:

Ask the students to create a hypothetical occupation that has the responsibility of helping people to conserve energy. What would the job be like? How would the worker do it?

materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity to list personal energy using devices, the student will be able to, through values clarification and decision making, reduce the amount of usage by 40%.

Developed by: Dan Grimes
EME

ILLUSTRATION OF ACTIVITY
I Can Reduce My Use

Ranking	Energy Using Devices	Point Value Consumption	Points for My Use	Points Reduced	Conservation Balance
4	Water Heater	3	2	0	2
3	Gas Furnace	3	3	1	2
2	Lights	3	3	2	1
6	T.V	3	3	2	1
1	Car	3	3	1	2
9	Electric Blanket	1	3	3	0
8	Lawn Mower	1	1	0	1
10	Fireplace	3	1	1	0
5	Stove	3	3	1	2
7	Radio	1	3	0	3

Total 25 Total 14

100% - 58% = 42% Reduction

Points for My Use:

3 points if used a great deal
2 points if moderately used
1 point if used very little

Point Value Consumption:

3 points if a major amount
2 points if a moderate amount
1 point if used very little amount

title: "Paper, Paper, Paper, - Let's Conserve!"



uses



concept: There are many ways to conserve energy.

objective: Given the opportunity, the student will be able to practice conservation techniques after assessing the amount of paper products he/she uses daily.

time: Several sessions

subject matter area: A11

grade: 4-6

implementation:

- Activity:
1. Have the students keep track of all the paper products which they use at home, and at school, for one day. This could be done by having the students list the various paper products as they use them and then keep tally of each repeated use. Class time could be used to set up the lists.
 2. Have a class discussion on the results of the students' lists. Examples of questions which might be asked:
 - a. Which paper products were used the most?
 - b. Which were used the least?
 - c. Is it better to use colored or white paper? (e.g. pink napkins vs. white napkins.) The dye in paper products is more damaging to the environment, even though the colors may look pretty.
 3. Have the students develop paper conservation activities. A few examples of such activities follow:
 - a. When the students come to class in the morning, tell them to take out a single sheet of notebook paper. Tell them that this is the only piece of paper they can use for assignments for the entire day. This will involve making better use of the paper (e.g. size of writing, spacing, using both sides, etc.). Eventually

materials:

Re-cycle Box
Newspapers for art projects



LOOK THROUGH
FOR VARIETY OF
CONTENTS



Implementation:



Activities: (cont.)

- students will have to erase their completed work and reuse the paper. Students should appreciate our paper supply after this experience and would hopefully use it more wisely.
- b. Have students keep track of the number of times cloth hand towels could be used rather than paper towels for drying hands. Perhaps the "linen hand towel" machines could be used in school restrooms rather than the paper hand towel dispensers. As an art project, students could make attractive terrycloth hand towels for use in the kitchens at home and in the school kitchen.
 - c. Very often, much unwanted advertisement-type literature is received in the mail. One possible solution to this problem would be for people to be aware of the option to notify the post office to stop delivering such junk mail. If enough people did this, perhaps a change would be brought about.
 - d. Have each classroom keep a recycle box for used paper. The contents of these boxes should be collected once a week and taken to a recycling center.
 - e. Have students think of ways in which paper could be reused. An example might be various uses for newspaper, such as:
 - Rolling the paper into fireplace "logs."
 - Using newspaper for papier mache' or other aesthetically pleasing art projects.
 - Another example for reuse of paper would be to have families reuse their "old" grocery sacks when going to the grocery store. Just take 4 or 5 grocery sacks from home to the store when shopping and have the clerk use them when bagging the groceries.

Materials:



implementation:



Activities:
(cont.)

SUGGESTED CAREER AWARENESS ACTIVITY:

Visit a paper mill to see the various jobs necessary to produce paper. Invite a person who runs a re-cycling center for paper to talk to the class about his/her job.



materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, students will be able to list at least 5 paper items which are used each day with suggestions as to how each one can be re-used/conserved upon in several alternative ways.

Developed by: Dan Grimes
EME

title: "Am I Energy-Wise?"



uses



concept: There are many ways to conserve energy.

objective: Given the opportunity, the students will learn the many ways they make use of energy and ways they might conserve it by keeping a detailed personal record.

time: 2 - 30 minute sessions

subject matter area: Science, Language Arts

grade: 5

implementation:

- Activity:
1. The teacher and students will discuss how they use energy each day.
 2. Students will each purchase a small notebook to carry with them to keep track of the appliances and other energy consuming activities they carry out each day.
 3. Honesty is of great importance as this is a scientific experiment.
 4. The teacher will assign students to record in a notebook the energy sources (services) they use each day.
 5. Each student will make a chart at school and each morning will tally the energy uses of the day before.
 6. After the first week, the students will hand in their charts.
 7. The teacher and class will discuss ways to cut back on everyday energy uses.

materials:

Small notebooks
Pencils
Poster board and magic markers



implementation:



- Activities: 8. Students repeat steps 4 and 5 trying to cut back on their daily use of energy.
(cont.)
9. At the end of the second week, the students will compare their charts with those of the previous week.
10. There should be a class discussion on what "sacrifices" each had to make to cut the energy consumed.
11. Class discussion - "Was it worth it? What do we do now?"

SUGGESTED CAREER AWARENESS ACTIVITY:

People who work in the school can be interviewed to identify their uses of energy in their jobs and what they can or are doing to conserve it.



materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given an opportunity, the student will list five ways he/she uses energy and how these uses can be conserved.

Developed by: Sara Campbell
Cheyenne, WY

Revised by: Dan Grimes
EME

title: "The Last Three"



uses



concept: There are many ways to conserve energy.

objective: Given the opportunity, the student will consider uses of electricity around the home in order to determine which are most or least essential, thus making choices in conservation of energy.

time: 1- 30 minute session

subject matter area: Science, Language Arts

grade: 5-6

implementation:

- Activity:
1. The students are asked to make a "list" (thirteen) of home appliances that require electricity. This would include anything which plugs into an electrical outlet and which they themselves use fairly often.
 2. The students are then asked to consider which three of the listed items would be easiest to give up if there was a sudden acute power shortage and everyone was asked to cut down on their use of electricity. They are then asked to cross these items off their lists.
 3. The students are next asked to think about the remaining ten items and decide which three would be the last to be given up if the shortage became even more acute. The last three are to be marked with asterisks.
 4. Volunteers are then asked to tell which items they felt should be the first to go, which the last.
 5. The teacher may or may not include his/her own list and choices.
 6. A follow-up exercise can be done by putting sentence stems on the chalk board such as:
 - a. I learned that I.....

materials:

Pencils and paper



Implementation:



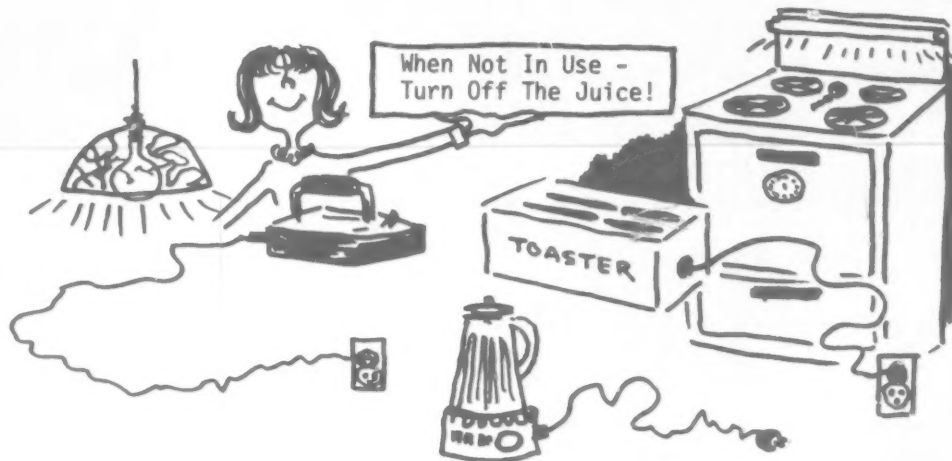
Activities:
(cont.)

- b. I was surprised that I.....
- c. I realized that I.....
- d. I discovered that I.....

- 7. The students could be asked to respond verbally or in writing. This not only provides feedback about the activity, but also helps clarify and reinforce the ideas that are brought up in the class discussion.

SUGGESTED CAREER AWARENESS ACTIVITY:

The student could list names of jobs that require the use of the appliances which could be considered non-essential in the home.



materials:



SUGGESTED ASSESSMENT PROCEDURE:

The student, given the opportunity, will respond verbally or in writing his/her reasons for his/her decisions on ways to conserve energy in the home.

Idea by: Penney's Forum Magazine
Spring/Summer 1972

Adapted by: Ed Walters
Eugene School District
Eugene, OR

Revised by: Dan Grimes
EME

title: "Peter and Alice in No-Energy Land"



uses



concept: There are many ways to conserve energy.

objective:

1. Given the opportunity, the student will be able to recognize misuse of electrical energy.
2. Given a list of appliances, the student will be able to categorize them as being necessary, somewhat necessary or unnecessary.

time: Varied

subject matter area: Science, Social Studies,
Creative Dramatics

grade: 4-5

implementation:

The length of time required to complete this activity is flexible. The research work and time needed by students to paint their cardboard appliances could be done in class or could be assigned to do at home. The skit, including any practices, would depend on how much classtime the teacher would want to devote to the activity. The skit can be memorized, read or improvised in any manner the class decides.

Activity:

1. From the following list of electrical appliances, a team of students will choose one appliance. The students will be responsible for researching as much background information as possible on this appliance. This research should include the approximate date of invention and information on the inventor or persons responsible for introducing the item to the public.

Electric lights or lamps
Dishwasher
Clothes washer
Dryer
Refrigerator
Air conditioner
Electric space heater
Iron

Electric range
Compacter
Freezer
Electric ice cream maker
Waffle iron
Sewing machine
Hot plate
Ice crusher

materials:



Large pieces of cardboard from discarded boxes. These can be obtained from most local stores. Magic markers or poster paint. Old magazines for pictures of early models of appliances. Reference books.



implementation:**Activities:**
(cont.)

Toaster	Electric Fan
Electric frying pan	Electric can opener
Mixer	Electric clock
Blender	
Electric toothbrush	
Hair dryer	
Radio (clock type)	
Tape recorder	
Television	

*The teams should decide as a group how to find the information. (e.g. telephone an appliance store, encyclopedias, ask an appliance repair person, etc.)

2. Using old magazines, the student should locate some pictures of the appliance from early models to present day models. Compare the present appliance to the past. (List the differences.)
3. The student will obtain from a local store, a piece of waste cardboard approximately one meter tall on which to draw, in magic marker or poster paint, a model of his/her appliance. These will be used in the skit the class will put on.

SUGGESTED CAREER AWARENESS ACTIVITY:

Invite an appliance salesperson to come to visit the class to share his/her knowledge of appliances in the following areas:

1. electrical energy use (old models vs. new models).
2. conservation techniques .
3. future designs coming up.
 - a. have the students design (creatively) appliances in the future. (anything goes!!!)

materials:**SUGGESTED ASSESSMENT PROCEDURE:**

Given the opportunity, the student will be able to 1) describe five (5) misuses of energy in the home life of "Peter and Alice in No-Energy Land", 2) evaluate the usefulness of appliances by categorizing them.

Developed by: Robert L. Ball
Cheyenne, WY

Revised by: Dan Grimes
EME

SKIT

PETER AND ALICE IN NO-ENERGY LAND

Props: Large appliances made of cardboard.
Any other furnishings as needed by the children.

Cast of characters: Peter
Alice
Mother
John
Mary
Children to take the parts of the appliances

ACT I

Scene: The home of Peter and Alice, ages 9 and 10. Morning. The children are on cots in their bedroom, just being awakened by their electric radio alarm clocks ringing and playing. The TV set is also on. (The children taking the parts of the appliances can indicate being turned on by slight shaking and buzzing.)

PETER: (Switching off his alarm, but leaving the radio on softly.) Gee, it's morning already. I'm still tired, because I stayed up late last night watching TV.
(He notices that the TV set is still on.)
Looks like I forgot to turn the TV off last night again. Oh well, I'll just leave it on so I can watch the cartoons later.

ALICE: (Waking up sleepily)
Turn to Channel 4, Pete. I want to see Capt. Kangaroo.
(She turns a lamp on.) (The children both put on robes.)
I'm hungry. Let's go get some breakfast.
(They leave, forgetting to turn off the lights, TV, or radio.)

LAMP: She left me on again, My bulb gets tired from being on all day long.

TV: I'm on too. I get tired of playing for just you guys. My tube is getting weaker.

RADIO: How about me. They keep me on day and night.

Scene: Kitchen - Many appliances (children) are standing around.

MOTHER: Good morning, children. Did you both brush your teeth with the electric toothbrush?

PETER: Yes. I'm sure glad we got that. I get tired using my plain old toothbrush. My arm gets weary.

ALICE: Put some toast in the toaster, Mom, and I want my juice all whipped up in the blender this morning. It tastes better that way. Can I open the juice with the electric can opener?

(Children and Mother go around opening various things and operating the appliances.)

PETER: It's hot in here. Are you sure the air conditioner is turned up all the way?

MOTHER: Yes, it's probably warm because I've been using the range all morning. My, that dishwasher makes a lot of noise. I'll have to call the repairman. Maybe it's because we use it so much, but I couldn't be without it.

ALICE: You'll drive us to school today, won't you Mother? I'm tired and three blocks is a long way.

MOTHER: Yes, as soon as I put a few clothes in the washer and get the dryer going.

(Mother starts both appliances and suddenly there is a loud explosive sound. All appliances fall down and Mother exits along with the children.)

ACT 2

Scene: Children are standing alone on a deserted stage. It should be darker if possible.

ALICE: Peter, what happened? Where are we?

PETER: I don't know, Alice. It's so dark and spooky here. Where are all the lights? Look, I think I see someone coming down the road over there.

(Two very sad looking children are walking slowly toward them.)

PETER: Hey, you there. Where are we? What is the name of this dark place?

FIRST CHILD: Why this place is called "No Energy Land" and it's dark like this always.

SECOND CHILD: Yes, the sun never comes out anymore, because the pollution is too thick.

ALICE: What an awful place. How did this happen? Quick, I can hardly breathe out here. Can we go into your house? What are your names?

FIRST CHILD: My name is John, and this is my little sister, Mary. Come with me up the road. The house is cold and dark, but it's better than being outside in this air.

Scene: Children are now in a dark room, obviously cold, as everyone is shivering. The appliances from the first act, can be present, but all giving the appearance of being dead. (Head flopped over - half lying position.)

JOHN: (Passing out blankets to everyone) Here, put these around you. It's very cold in here.

ALICE: But why don't you turn on your furnace? And please, turn on some lights. I can hardly see a thing.

MARY: We'd like to, but there hasn't been any electricity for many years now. Long ago, we were told to start conserving energy, or we'd run out, but nobody listened. We were told that we were polluting our air with fumes and waste too, but we didn't listen.

JOHN: Yes. We always left on lights and appliances, and always drove everywhere, and then one day, everything just stopped.

MARY: No one has been able to start anything since. I'm so tired of the dark and the cold.

ALICE: I'm getting hungry, John. Do you think I could go to your refrigerator and get something to eat?

JOHN: All we have is some old canned food left over from the good days. Our refrigerator doesn't work anymore.

(The children open the can (manually) and start to eat.)

PETER: Ugh. This tastes terrible cold. Can't we heat it up on the stove?

MARY: Our stove doesn't work anymore either. Oh, I wish we had been more careful with our energy when we had it.

ALICE: I wish we could get back to our own nice home. We're going to be late for school, Peter. Don't you children go to school?

JOHN: We can't anymore. There is no way to light the school or keep it warm. You might think we're lucky, not having to go to school, but there is nowhere else to go either. All the movies are closed, and the bowling alleys and skating rinks too. We can't go outdoors much because of the polluted air. So we just stay here and wish we had listened and conserved energy.

ALICE: Oh, Peter, we must get out of this terrible place and warn everyone at home of what might happen. Come quickly.

The children run out of the house. Stage should be quite dark now. Both stumble and fall in the darkness.

ACT 3

Scene: Kitchen (Children are both sitting on the floor, looking stunned. Mother walks in from the other room.)

MOTHER: Children, are you alright? We must have had too many appliances going at once, and blown all the circuits.

PETER: (Dazedly) Yes, Mother. I guess we're O.K. Alice? Have we been here all the time?

ALICE: I don't know Peter. It seemed so real in that awful, cold dark place. I'm sure glad we're back. Do you think it's too late for us to start being different? Do you think we can help people to understand why we must stop wasting energy?

PETER: I hope we aren't too late, Alice. We can try.

MOTHER: What are you children talking about? Come on. Climb in the car and I'll drive you to school.

PETER: Oh, no, no Mother. We'll walk. It's a beautiful day, and the air is clear and fresh. I want just to go out and breathe it in.

ALICE: First, Peter, let's go and turn off all those lights we left on and the TV and radio. We have a lot of thinking to do on the way to school. Maybe we can get our teachers to help. We must never end up like poor John and Mary.

PETER: Goodbye Mother. We'll tell you the story of Alice and Peter in "No Energy Land" when we get home.

END



activities



Student Handout
Name _____

Date _____

CATEGORIZING HOUSEHOLD APPLIANCES

NECESSARY	SOME WHAT NECESSARY	UNNECESSARY

Directions: Put the name of the appliance in the column that you feel describes its importance.

Electric clock
Electric lawn mower
Sewing machine
Hot plate
Ice crusher
Electric fan
Electric can opener
Iron
Electric frying pan
Blender

Electric lights or lamps
Dishwasher
Clothes washer
Dryer
Refrigerator
Air conditioner
Electric space heater
Toaster
Mixer
Waffle iron

Electric toothbrush
Hair dryer
Radio (clock type)
Tape recorder
Television
Electric range
Trash compactor
Freezer
Electric ice cream maker

title: "Something Useless"



uses



concept: There are many ways to conserve energy.

objective: Given the opportunity, the student will describe ways that "throw-away" products can be re-used or re-cycled.

time: Less than 5 minutes **subject matter area:** Language Arts - communication **grade:** 4-6

implementation:

Activities: The students will describe how various objects can be re-used. Students will try to convince the rest of the class that a used object is useless.

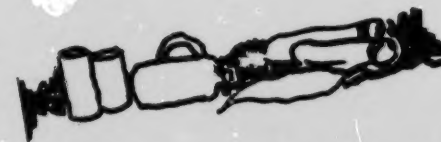
1. Choose a student who is willing to try to convince his/her classmate that an old newspaper is useless (any object will do).
2. Allow the class to respond by disagreeing and giving suggestions for re-using and/or recycling the object.
3. Follow-up with a class discussion about the importance of recycling and re-using products.
4. Encourage the students to find an object at school or home that they could bring to class and present as being useless. Challenge the students in doing this.

Note: This activity can be used to help students become better presenters in front of people.

materials:



Any used object such as an empty can, used newspaper, used paper bag, old toothpaste container, etc...



implementation:



SUGGESTED CAREER AWARENESS ACTIVITY:

Invite the local trash collector to class to talk about his/her job and to point out the importance of reusing and recycling products instead of throwing them away.

materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, the student will be able to share an object with his/her peers and discuss ways it could be reused or recycled.

Developed by: Dan Grimes
EME

title: "Toys - How Many Do We Need?"



uses



concept: Every decision made involving energy affects standards of living.

objective: Given the opportunity, the student will compare his/her use of energy and lifestyle to that of a less technically developed society and consider changes he/she could make in the future.

time: Several sessions

subject matter area: Science, Social Studies,
Art, Language Arts

grade: 4-6

implementation:

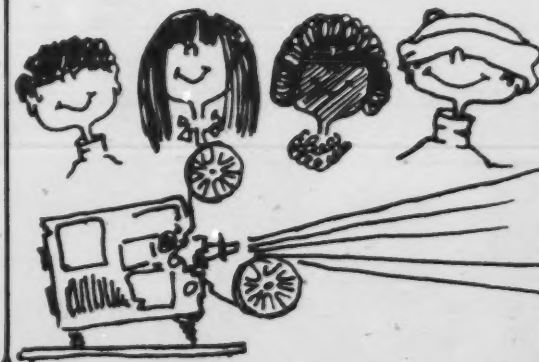
- Activity: 1. Show movie, "Spin! Toot! Scoot!" which demonstrates how energy is used to create movement in toys - stimulates child's interest in his/her own toys. Children should list all toys that they personally own in four columns under, Used Often, Used Occasionally, Used Seldom, and Used Never. List toys a child might own in a less technically developed society. Consider energy consumed in production and use of toys. Discuss differences and reasons for differences. List all toys which no longer are used. How old are they? List toys that became defective and were disposed of, speculate about how that could be avoided in the future. What could be done with them?
- a. Possible class activity: Collecting toys for charities, exchanging used toys at Christmas, "garage" toy sale, etc.
2. The students will experiment with giving up various items. First day - give up one item, second day, add one more, third, etc. Continue for five days unless a student feels he must stop sooner. Discuss changes, advantages, discomforts, substitutions. Re-examine above list for possible changes.

materials:



Films:

"Spin! Toot! Scoot!" MOYM 1969.
"Buy and Buy" NETY 1973 - A TV cartoon show pressures children to buy a gimmicky fad toy. Discuss media and peer pressure to buy mechanical toys which do not allow for involvement on the part of the child. (Optional activity - discuss media advertising techniques.)



implementation:

Activities: 3.
(cont.)

The students will inventory their own family's electrical appliances. Divide this list into two parts, those appliances necessary to maintain a comfortable lifestyle and those which are considered to be beyond these needs, (i.e., luxuries).

Interview parents concerning who makes decisions about the purchase of major electrical appliances. Ask what influences their selection of brand, size, model, etc.

a. Make a chart (whole class) as follows:

Motivation:

	Reason for purchase	Considerations
Major Appliances	WASHER	On sale, old one broken, larger model came out, etc.
	DRYER	Brand, size, accessories, cost etc.
	DISHWASHER	
	ETC.	

b. Discuss variety of responses. Include such things as economy of replacement vs. repair, standard vs. deluxe model.

SUGGESTED CAREER AWARENESS ACTIVITY:

Follow up project: Design or build a toy which allows for maximum enjoyment but requires minimum expenditures of energy both in production and use.

materials:

SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, the student will compare his/her use of energy to that of a less technical society and state means of conserving energy in his/her family life, in either verbal or written form.



Developed by: Kathy Walker
Eugene School District
Eugene, OR

Revised by: Dan Grimes
EME

title: "What Was It Like Back Then?"



uses



concept: Every decision made involving energy affects standards of living.

objective: Given the opportunity, the student will be exposed to a different style of growing up as experienced by an older family member or neighbor.

time: 2 - 30 minute sessions

subject matter area: Social Studies, Language Arts

grade: 5

implementation:

Activity:

Each child will be assigned to interview a grandparent (parent or neighbor) about: "What was it like when you were my age? What different kinds of energy did you use?"

1. The teacher and class will discuss how life style in the U.S. has changed in the twentieth century.
 - a. Who do you know that might be able to tell you something about the early 1900's?
 - b. Perhaps the teacher will want to ask a resource person to come to the classroom (a practice interview).
2. The teacher will assign each student to interview an older person (at least 40 years) on, "What was it like growing up?"
3. The teacher will send a letter home explaining the assignment.
4. The teacher will give each student a sheet of suggested questions. (Guidelines.)
5. The students will be instructed on "proper" questions to ask and what not to ask.

materials:



Paper, pencils.
One person to interview for each student.
Resource person
Bulletin board materials.



implementation:



- Activities: (cont.)
6. The child will report to the teacher who he/she plans to interview.
 7. There will be a one week work period in which the student will interview (at home) and write a report on that interview. It would be desirable if each student could bring a picture of the person interviewed as a youngster.
 8. The teacher will correct each paper. Then each student will rewrite the interview on penmanship paper. (It would be nice to give each person that was interviewed a copy of the report.)
 9. The teacher and students will create a bulletin board of the different interviews.
 10. On the due date have a class discussion on "What was the most interesting thing I learned about life and energy in the years past?"
 11. Students will write thank you letters to the people they interviewed.

SUGGESTED CAREER AWARENESS ACTIVITY:

As a part of the interview, the students could inquire about what led the interviewee to choose the job he/she chose, and how it has changed through the years.

materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, the student will compare and contrast the life of an individual in the early 1900's to his/her own life today in either a verbal or written manner.



Developed by: Sara Campbell
Cheyenne, WY

Revised by: Dan Grimes
EME

title: "Our Leisure Time Activities"



uses



concept: Every decision made involving energy affects standards of living.

objective: Given the opportunity to participate in a values clarification exercise, the student will be able to become more aware of the relationship between standard of living and energy use.

time: 1-2 30 minute
sessions-depending
on grade level

subject matter area: Social Studies (values)

grade: 4-6

implementation:

PROCEDURES:

1. Ask each student to make a list of five leisure time activities they enjoy doing.
2. Rank in order each activity from the most important to the least important. Place a 1 next to the most important, a 2 to the second most important, etc..
3. Next to each item place a \$ (dollar sign) if the activity cost money each time it is performed.
4. For each item assign a mechanical energy point value. Give the activity a 3 if it requires a major amount of mechanical energy consumption, a 2 if a moderate amount of energy consumption and a 0 if it doesn't require any artificial energy sources at all.
5. For each item give 3 points for performing the activity a lot, 2 points if the activity is performed occasionally, and 1 point if performed seldom.
6. What have you learned about yourself in relation to the list of leisure time activities?
7. Next, explain to the class that a severe energy crisis has come about, and all people must conserve as much energy as possible; at least 50%!!!!

materials:

Paper
Pencil



implementation:

(continued)

At this point have the students begin subtracting points away from the leisure time activities they personally feel could be reduced to save energy. The object is to see how many students would be willing to reduce their energy consumption rate in their high energy using leisure activities. If so, how would they do it and for what leisure activities? Could they substitute any leisure activities that require energy intake? Ask the students to reduce their energy consumption by 50%.

Class Discussion for Follow-up:

1. Are you willing to reduce by 50%? (Why or why not?)
2. How did you conserve energy? Which items did you reduce?
3. What types of activities can we do that are fun and do not require much artificial energy sources?
4. Discuss energy conservation as related to leisure time activities.

**materials:****SUGGESTED ASSESSMENT PROCEDURE:**

Given the opportunity, the student will be able to list ways he/she can conserve energy in leisure time activities.



Developed by: Dan Grimes
EME

FOR THE TEACHER:
ILLUSTRATION OF ACTIVITY - SAMPLE ONLY

Ranking	Activity	\$	Amount of Consumption	Amount of Use	Amount Reduced
2	Water Skiing	\$	3	1-0=	1
1	Guitar	0	0	3	X
4	Sailing	\$	1	2-0=	2
5	Riding a Motorcycle	\$	1	3-2=	1
3	Snow Skiing	\$	2	2-0=	2

Total points 12

6

Amount of Use
3 points if done a lot
2 points if done occasionally
1 point if done seldom

Amount of Consumption
3 points if a major amount of energy is used
2 points if a moderate amount of energy is used
1 point if very little energy is used
0 point if no energy is used

title: "Things I Like To Do"



uses



concept: Every decision made involving energy affects standards of living.

objective: Given the opportunity to make a list of things they like to do, the students will be able to examine the items and determine a value for each.

time: 1 - 30 minute
session-depending on grade
level

subject matter area: Social studies (values)

grade: 4-6

implementation: Ask the student to make the following chart on a sheet of paper:

Things I like to do	\$	E	e	F&/or M	"10"	Date
1.						
2.						
3.						
4.						
5.						

Ask the students to make a list of 5-10 things they like to do.

1. Place a \$ sign by any item which costs more than \$3.00 each time to do it.
2. Put an "E" in front of any item which uses a lot of mechanical energy to perform.
3. Put a small "e" next to the items that require a little mechanical energy to perform.
4. Using the code letters "F" and "M", record which of the items on your list you think your father or mother might have had on their lists if they had been asked to make one at YOUR age.
(F= Father and M= Mother)

materials:

Paper
Pencil



implementation:



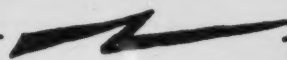
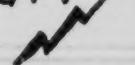
(continued)

5. Place a number "10" in front of any item which you think would not be on your list 10 years from now.
6. Finally, go down through your list and place near each item the date when you did it last.

Discussion: Teacher should ask students for the responses they put down on each item. Ask why?

***Key questions-**

1. What does your list tell you about the things you like to do?
2. List ways that you could conserve energy from the list of things you like to do.
3. Did your parents use less energy at your age than you? Why?

RESEARCH  ELECTRICITY 

materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, the student will be able to make a value judgment by making a verbal or written statement about the things he/she likes to do.



title: "Imagine - Energy of the Future!"



uses



concept: Every decision made involving energy affects standards of living.

objective: Given the opportunity, the student will be given a "story beginning" to continue and finish with predictions he/she might have. The assignment is not scientifically oriented; its purpose is to start students thinking.

time: 5 - 30 minute sessions

subject matter area: Science, Language Arts, Art

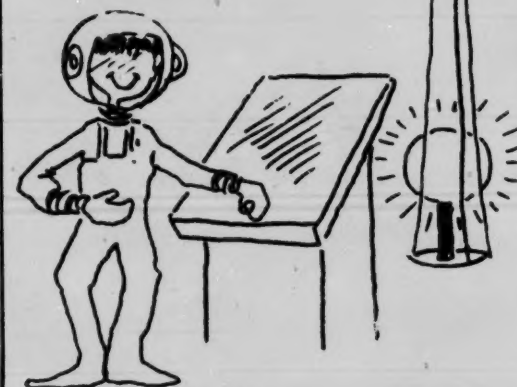
grade: 5

implementation:

- Activity:
1. The teacher and students will discuss energy sources and uses in the distant future. (A list on the board would be helpful.)
 2. The class will review how to write a story.
 3. The teacher will hand out the "story beginning" to each student. (See second page for example.)
 4. The student will finish the story as he/she imagines it might be.
 5. The teacher will go through each paper grammatically with the student.
 6. Each student will rewrite his/her story and make a folder illustrating some of the appliances (etc.) that he/she mentioned.
 7. Over a three day period, the students can read their stories and show their pictures to the class. (Too many in one day gets boring.)

materials:

Imaginations
Paper
Pencils
Story beginning
Construction paper for folders
Crayons



implementation:



Activities: 8. Story beginning (example).
(cont.)

"Dad! Dad! We're going to crash!"

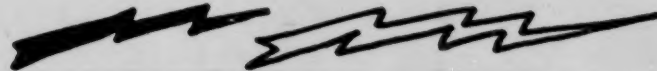
"We'll be fine. I see the Earth below us. I've heard there are nice Earthlings down there."

Bang! Crash! Thud!

"Oh wow, look over there! Do you see that....."

SUGGESTED CAREER AWARENESS ACTIVITY:

Included in the story could be descriptions of the kinds of jobs people are doing in the "future."



materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given a story beginning, the student will be able to write a creative story depicting energy sources and uses in the distant future.



Developed by: Sara Campbell
Cheyenne, WY

Revised by: Dan Grimes
EME

title: "The Past: You Are There!"



uses



concept: Every decision made involving energy affects standards of living.

objective: Given the opportunity, the student will role play, for a day, a person from a different era in the U.S. and research his/her era.

time: Several sessions

subject matter area: Science, Social Studies
Language Arts

grade: 5

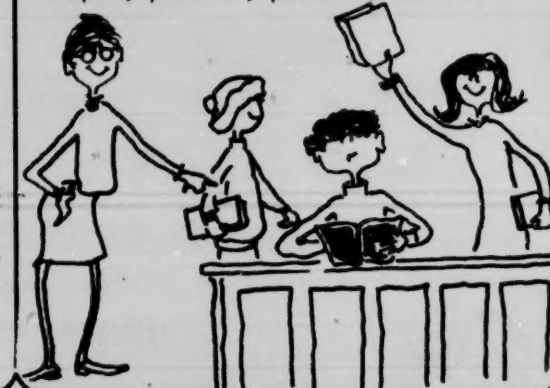
implementation:

- Activity:
1. This project is an excellent opportunity for the teacher to integrate science and social studies.
 2. Teacher and class discuss how energy has changed the life-style in America as new inventions have appeared (a very general discussion, perhaps in 50/100 year intervals).
 3. Teacher and class discuss different famous people who lived during the different times.
 4. Each student decides who he/she would like to become for a day, as a fifth grader. (The teacher can regulate so each time period is represented.)
 5. One week of individual study follows. Each student will discover as much about "him/herself" as possible. What type of energy did this person use as a fifth grader? What kind of everyday life did he/she lead?

materials:



An ambitious group of students.
One patient teacher.
Lots of reference materials and history.
The American Story
Frontier Enterprises
Box 1000
Oskaloosa, Iowa 52577.
Paper, pencils, posters, colors.



implementation:

- Activities: (cont.)
6. The teacher may put books around the classroom for students to examine. Also charts of different styles of clothing, suggestions about cooking, bathing, travel, heat, etc. would be helpful.
 7. On the assigned day, each student will come to school dressed as his subject. The children will sit in chronological order with a sign stating their name and the year.
 8. Each child will present a speech on his lifestyle as a fifth grader and the energy he might have used in one day. Each speech will begin, "Hello, I am _____." In this way the presentation will be given in the first person.
 9. The children may ask questions after each talk.
 10. An overall discussion of the days events may follow completion of the task.
 11. Suggestions:
 - a. A teacher might want to dress and appear as someone else also.
 - b. The teacher might want to prepare some games and activities from the past to break up the afternoon.

SUGGESTED CAREER AWARENESS ACTIVITY:

As a part of the research, the student could find out about the childhood interests of the person being studied and compare those personal interests with those of him/her self.

materials:**SUGGESTED ASSESSMENT PROCEDURE:**

Given an opportunity, the student will compare and contrast the life style and energy-use of a time in the past to his/her own today by role playing.



Developed by: Sara Campbell
Cheyenne, WY

Revised by: Dan Grimes
EME

title: "A Trip To Disneyland"



uses



concept: Social, economic and political pressures influence the efficient and economical use of energy.

objective: Given the opportunity, the student will evaluate the positive and negative counterbalance of various energy sources.

time: 2 - 30 minute sessions

subject matter area: Mathematics

grade: 5-6

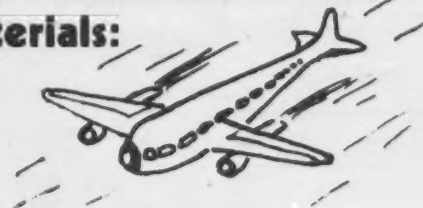
implementation:

- Activity:
1. Each student will pretend he/she is going to Disneyland with \$120.00 to spend. He/she will select his/her method of transportation, what he/she will eat, what he/she will do at Disneyland, and all other items. He/she must get to Disneyland and back in three days. All exhibits and rides cost \$1.50 each. A book of tickets cost \$22.50.
 2. How will he/she get to Disneyland? What to do at Disneyland? Food? Motel? Give one or two days for the students to research and come up with their decisions. Discuss the energy used in his/her trip. Was any energy wasted? What suggestions does he/she have for people who want to make this trip in the future? Is it worthwhile for the amount of energy used?

SUGGESTED CAREER AWARENESS ACTIVITY:

The student will list the jobs of people who are involved in each area of his/her trip (e.g. transportation workers, etc.).

materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, the student will be able to plan and budget a hypothetical trip, identify the energy used in his/her trip and determine if his/her trip was planned satisfactorily.

Developed by: Peggy Neviasser
Eugene School District
Eugene, OR

Revised by: Dan Grimes
EME

title: "Industry vs. Environment - Who Wins?"



uses



concept: Social, economic and political pressures influence the efficient and economical use of energy.

objective: Given the opportunity, the students will be placed in a situation where they are either a business person wanting to construct a large coal mine (example), or a conservationist wanting to 'save' the land and animals that inhabit the area in question.

time: 4 - 30 minute sessions

subject matter area: Science, Social Studies
Language Arts

grade: 5

implementation:

- Activity:
1. The teacher and students will discuss why we need large factories and mines, etc., as well as why we need to be concerned about the environment.
 2. The teacher will divide the students into two groups.
 - a. Group A will be industrialists.
 - b. Group B will be environmentalists.
 3. The teacher will give each student in Group A plans for a large coal industry. (Each, then, becomes a representative of that company.)
 4. The teacher will give each student in Group B a list of environmental hazards of that particular plant. (Each, then, becomes involved in that cause.)
 5. The teacher will divide the class into working units of two A's and two B's. Each group will become a team.
 6. It will be the job of each team to meet and discuss compromises that could be made. (Two ½ hour periods.) (Some teams may not be able to agree on anything.)

materials:

Paper and pencils
Plans for industry and hazards it might cause.



implementation:



- Activities: (cont.)
7. On due date, each team (two A's and two B's) will present its decisions on whether the industry will come to their state and the compromises they reached during their discussions.
 8. The teacher and class will discuss the advantages and disadvantages of the different teams' decisions.
 9. Each student will write a couple of paragraphs telling what he/she learned during this specific exercise.
 10. The teacher might want to chart the different decisions and compromises on poster board for all to look at.

SUGGESTED CAREER AWARENESS ACTIVITY:

Decision-making - The student will list the choices involved in the activities as well as the outcomes if each choice would be made. The student will then make a personal decision before discussion in the group.



materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, the student will express either in verbal or written form his/her decisions, and compromises that were reached during discussions.



Developed by: Sara Campbell
Cheyenne, WY

Revised by: Dan Grimes
EME

title: "Six Life Roles and a Mini-Community"



uses



concept: Social, economic, and political pressures influence the efficient and economical use of energy.

objective: Given the opportunity, the student will realize that individuals may band together in citizen groups to affect political/social/economic choice.

time: several weeks
on-going

subject matter area: A11

grade: 4-6

implementation:

- Procedures:
1. Teacher provides display area (mural, large table or floor space) for construction of a mini-community.
 2. On the display area the teacher provides the physical features of the community. (Boundaries, forest, river, etc.)
 3. Teacher leads discussion of how a community develops and what goes into the making of one. List all student responses on the board. (The teacher might want the students to research the following areas of a community before listing items.)

Example:

Occupations	Goods	Services	Transportation	Recreation	Other
farmer	food	school	cars	hiking	
doctor	clothing	church	buses	boating	
teacher	cars	stores	train	movies	
_____	_____	_____	_____	_____	
_____	_____	_____	_____	_____	

materials:



Large table or mural on
floorspace - pine cones or ? for
trees.
Tempra paints- glue -paper-scissors

Film:
"A Field Becomes a Town" MGM 1965

Procedures Continued:

2-

4. Share with the students the mini-community display area that has been prepared. Explain to the students that they are going to build a mini-community from scratch and role play 6 life roles. Producer-worker, family member, consumer/buying things, citizen/making decisions to help the community to be a good one, Individual/things you like to do, Learner/continue to learn, your way. Using the attached hand outs have the students make a community folder.
5. The following six steps in constructing the community are related to the life roles. Discuss with the students each step and how it relates the life role.

I. Citizen Life Role.

- A. As a citizen, have each student become a member of a land-use planning committee to decide where each of the following land zones and items will be in the mini-community. Class Discussion.
 1. Industrial area - factories
 2. Recreation - picnic, camping, swimming, etc.
 3. Farm land - crops/food
 4. Residential - homes
 5. Commercial - services
 6. Energy generating plant - (What source of energy will be used?)

As a producer,
build each area.
- B. As a citizens group, have the students decide upon a street system for the mini-community. Select a group of students/producers to make the streets. As a group, name the streets.
- C. As a citizens group, elect a mayor, sheriff, and water, land and transportation commissioner.
- D. Have the students complete the Citizen Role hand-out.

II. Family Member Life Role.

- A. As a family member have the students select a parcel of land in the residential area and as a producer, build a house for the family.
- B. The student should decide what else they need and/or want for the family and either make it, bring it from home or pretend. (e.g. car, furniture, boat, playground, swimming pool. etc...) The student should be allowed to fix up his/her home area as they see fit as long as the planning committee agrees. Have the students submit a plan to the Land Commissioner if the need arises.
- C. Students fill out the Family Member Handout.

III. Producer Life Role

- A. Discuss the concept of Producer and how it relates to other life roles.
- B. List occupations a community might have.
- C. Have students select and role play a job.
- D. Have students build their place of work.

IV. Consumer Life Role

- A. Discuss the concept of Consumer and how it relates to other life roles.
- B. With the class responding, the teacher discusses and/or lists on the board the goods and services a community member buys and/or sells. (have each student fill out the consumer role handout.)

V. Individual Life Role

- A. Discuss the concept of the Individual Life Role. The teacher might want to relate it to self-awareness, interest and leisure time activities.
- B. Have each student observe the mini-community and then decide as an individual the activities they would like to pursue, (e.g. hobby at home, hiking, camping in the forest, swimming in the river, jogging, etc.) (See attached hand-out for Individual Life Role.)
- C. Discuss how this life role relates to the other life roles. Discuss concepts such as life styles depending on the Family and Producer roles. Discuss needs/wants as an individual and variables in real life that determine the outcomes. Do we always get what we want? Why?

VI. Learner Life Role

- A. Discuss with students the concept of life long learning and the ways people continue to learn throughout their life.
- B. Ask the students to list the things they like to learn and the ways they like to learn best on the handout titled "Learner Life Role".
- C. Discuss with the students how the other life roles affect the learning role.

VII. Follow-Up Activities - Role Playing Life Roles.

- 1. As citizens, the students can solve community problems that the teacher sets up, such as pollution of land, air, water, energy crisis, unemployment, etc. This sets the stage for group decision making.

e.g. Citizen Life Role

- The factory is polluting the air. The community needs the factory to produce goods and keep people working, but clean air is important too. What should be done?
- The factory is polluting the river. The community needs the factory but the river is important too. What should be done?
- The energy source supply used to generate electricity is extremely low. (e.g. River, coal supply, oil supply, etc.) People depend on this energy for use in the community. What can be done to assure a satisfactory supply of energy? (Develop and use a new source? Conservation? or both?)

Considerations to make as a class:

1. How does an energy problem affect the producer, consumer and citizen?
 2. What could each community member do to conserve energy?
- Factories, cars and local burning are polluting the air to the extent it is harmful. What should be done?
2. As a producer, each student could put their job into action by deciding what to charge for their goods and/or services, who needs it and/or what to do with the earnings.
 3. Make addresses for each dwelling - write letters to each other and use the post office.
 4. Make a telephone book with names, addresses and numbers.
 5. Keep a family budget - pay bills and buy goods and services on a weekly basis.

Discussion questions:

1. What would happen if no one worked in the community?
2. What would happen if citizens did not take an active part in voting, decision making and planning matters in the community?
3. Why do we need Laws and Rules in a community?
4. Why do we need recreation in a community?



activities



Page 5

Student Handout
Activity #

ME AS A LEARNER

Name _____

Things I Like To Learn

The Way I Learn Best Is

Student Handout
Activity #

ME AS A CONSUMER

Name _____

Goods I buy	Services I buy	Transportation I buy	Recreation I buy



activities



Page 8

Student Handout
Activity #

ME AS A CITIZEN

Name _____

Duties I have as a Citizen

- 1.
- 2.
- 3.
- 4.
- 5.

USES



activities



Page 9

Student Handout
Activity #

ME AS A PRODUCER

Name _____

Occupation _____
(Job Title)

Duties _____

Name of the place I work _____



activities



Page 10

Student Handout
Activity #

ME AS A FAMILY MEMBER

Name _____

My Needs	What I Would Like To Have

implementation:



SUGGESTED CAREER AWARENESS ACTIVITY:

Invite guest speakers to class to discuss their role in the community (e.g.: Mayor, Commissioner, Factory owner, etc.)



materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, the student will be able to describe verbally how citizens of a community work together to make decisions about economics, environment, and energy.

Developed by: Dan Grimes
EME

title: "Subject and Predicate Cards 'Mix and Match'"



uses



concept: Each form of energy is used in many ways.

objective: Given the opportunity, the student will be able to gain information about energy use by matching subject phrases with predicate phrases.

time: 1 - 30 minute session

subject matter area: Language Arts

grade: 4-6

implementation:

1. Prepare 2 sets of cards. One set should be a different color than the other. On one set of cards place the subject phrase of a complete sentence on each card. Place the predicate phrases on the cards of the other color. Complete all the cards using about 15 sentences. Sentences can be about energy sources, uses, occupations, etc.
2. Pass all cards out to the students.
3. Have the students move around to each other, comparing cards, until all cards are matched. Students will then read their matches.

Any kind of information can be placed on these two sets of cards: questions and answers about any subject, math problems, syllables of words, etc.

Besides giving children knowledge about whatever is on the cards, this activity provides practice in inquiry, reading, sentence structure, and oral communication.

materials:



Approximately 30 3" x 5" cards



implementation:

(cont.)

SAMPLE CARDSCard 1

1. A plant
2. Solar energy
3. A farmer
4. A scientist
5. A dam worker
6. The sun
7. A house
8. Nuclear power
9. A car
10. Geothermal energy
11. A river
12. A mine worker
13. The air
14. The land
15. Energy

Card 2

uses the sun's energy
 is a future energy source
 uses a lot of gasoline
 discovers new energy sources
 uses water to produce energy
 is a source of energy
 uses a furnace
 is a source of energy
 uses oil to help it run
 is found under the ground
 can be polluted
 works underground
 can be polluted
 can be polluted
 can be conserved

Note: Often correct matches can be made in more than one way.

materials:SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, the student is able to match correctly subject and predicate phrases that make complete sentences.

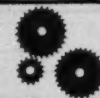


Developed by: Dan Grimes
 EME

title: "People and Energy Keep the World "Ticking" At Night"



uses



concept: Each form of energy can be used in many ways.

objective: Given the opportunity, the students will list of all the energy uses 'round the clock' and the people who keep the world 'ticking' at night.

time: 5 - 30 minute sessions

subject matter area: Social Studies, Career Awareness, Language Arts, Art

grade: 5

implementation:

- Activity:
1. The teacher and students will discuss different businesses that are manned twenty-four hours a day, and why. Examples: hospitals and nursing homes; refineries; trucking; restaurants; motels (some); electric companies; grocery stores.
 2. The class will make a chart (bulletin board) of night jobs and night people. Some of the students' parents might work a night shift. These kids will want to share some of their inside knowledge.
 3. The class will make a chart listing the major energies it takes to keep the world running at night. (Most should be the same as daylight hours.)
 4. The teacher will invite a resource person or two to tell students what it is like to work at night while most of the people are asleep. Example: trucker, nurse.
 5. Students can ask questions after the guest(s) has (have) spoken.
 6. The students will write thank you notes to speakers.

materials:

Penmanship paper, pencil.
Black construction paper.
Chalk.
Poster board.
Bulletin board materials.



implementation:

- Activities: 7. The teacher will want to send notes home to the parents explaining what the students have been discussing in class.
(cont.)
8. It might be suggested that parents take their child on a tour of their town some night about bedtime. This way he/she can see first hand what it's like at night.
9. Those students lucky enough to have had a tour can share their findings with class mates.
10. Teacher and students will discuss facts they have discovered about life and energy at night.
11. For a culminating activity, the class can create chalk pictures on black construction paper depicting the world at night.

materials:SUGGESTED ASSESSMENT PROCEDURE:

Given an opportunity, the student will name at least one 24-hour business, tell why it operates at night, and will list the major energies it uses.



Developed by: Sara Campbell
Cheyenne, WY

Revised by: Dan Grimes
EME

title: "Energy Technology Through The Ages"



uses



concept: Some human technologies and activities use more energy than others.

objective: Given the opportunity, the students will be able to describe human progress related to the harnessing of different energies through the use of student created murals.

time: 3 - 30 minute
sessions

subject matter area: Science, Art, Social Studies

grade: 5-6

implementation:

- Activity:
1. The teacher and students will discuss many of the things we have today, because of energy technology, that were not present in earlier times. (e.g. cars, planes, T.V., radio tractors, dams, telephone, etc.)
 2. The teacher and students will discuss how these changes came about.
 3. The teacher will explain the mural assignment, showing the things that were discussed.
 4. The teacher will divide the class into four sections:
 - a. Caveman to 1600
 - b. 1600-1800
 - c. 1800-1900
 - d. 1900-on.

The teacher should give a little background information about each time period.
 5. Each group will research its time period, deciding on the major advances.
 6. Each group will sketch on large white construction paper the pictures they want to use to depict their time period.

materials:



Reference books
Paper
Crayons, pencils, rulers (paints)
Bulletin board paper
Masking tape



implementation:



- Activities: (cont.)
7. The teacher will go over sketches with each group.
 8. The teacher will give each group a sheet of bulletin board paper to draw their mural.
 9. When the separate murals are finished, the class will connect them together in chronological order to make one long mural.
 10. Each group will discuss its pictures and the information found while researching.
 11. The mural can be placed in the lunchroom or hall for other students to see.
 12. The class might want to share its findings and mural with another class.
 13. The teacher might want to involve the art specialist in the creating of the murals.

SUGGESTED CAREER AWARENESS ACTIVITY:

Students can research and include in their presentation to the class, how the energy technology affected the jobs and lives of the people at that period, in addition to the new jobs that were created.

RESEARCH  ELECTRICITY 

materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity to participate in the creation of a mural, the student will be able to describe major energy developments occurring from cavepeople to the present.

Developed by: Sara Campbell
Cheyenne, WY

Revised by: Dan Grimes
EME

title: "Clothing - Made of Oil Products?!"



uses



concept: All industrial processes make use of several forms of energy.

objective: Given the opportunity, the student will be able to list ways through the use of the activities in this unit, that our society depends upon oil and oil products and recognize what the effects of a reduction in the use of oil-based products would have upon us individually.

time: Several sessions

subject matter area: Science, Language Arts
(creative writing)

grade: 5-6

implementation:

OBJECTIVES: Given the opportunity, the student will become aware of a number of oil and non-oil based products and their reaction to flame.
(cont.)

- Activity:**
1. Have the class list all of the various products made from crude oil. Examples might be: kerosene, gasoline, fuel oil, medicine, clothing, plastics. As a follow-up activity, have a discussion with the class on how we use the listed products in our daily lives. Have the students investigate home and school for ways in which products such as kerosene, gasoline, fuel oil, medicine, clothing, plastics, etc. are used.
 2. After approximately three or four days of investigation, have the students bring their lists to class. Make a chart to compile the information gathered by the class. (This chart could be similar to the Taba retrieval chart or an experience chart.) An example would be:

USES	Products		
	Kerosene	Fuel Oil	Gas

materials:

Butcher paper for oil products chart.
Oil-based and non-oil based products for the lab activity (e.g. polyester fabric, nylon, styrofoam cup, etc.)
Matches and beaker.
Asbestos pad



implementation:

Activities: 3.
(cont.)

After discussion, ask the students which product they would give up if it became absolutely necessary to do so. Have the students do a creative writing assignment on what life would be like without that particular oil product. What concessions would have to be made? For example, one student might give up gasoline, and as a result, have to walk or ride a bike everywhere.

a. Have the students share their stories.
b. Asking students to list all the products that they use which do not depend on oil in any way would help them realize our dependence on oil. They should realize that most things we use, depend on oil in one way or another. (e.g. Most products have to be transported. This commonly requires an oil product. Fertilizers for crops are derived from oil, rubber for tires is oil-derived. These are just a few examples.)

4. Another activity for the student involves testing various fabrics, which have been classified previously as either oil or non-oil products. The fabrics would be tested by burning them, and then recording and comparing the ash residue, smoke given off by each, odor emitted, and the way in which the fabric "burned" (e.g. brightly, in a puff, melted, etc.).

a. Of course, safety precautions should be reviewed for such an activity, and supervision would absolutely be necessary. When burning the oil-based products, one should do so under an inverted beaker or something similar, as poisonous gases are often emitted, as in the case of styrofoam.

materials:

implementation:



Activities:
(cont.)

- b. The enclosed chart gives some examples of several fabrics of oil and non-oil base and the results when tested with flame. Of course, one may expand upon these examples.
- c. Have students write a short summary of their observations from the tests made. Are there any major differences between oil and non-oil based products? Are there differences within each category? Might some of these products have been treated for flame retardancy?

SUGGESTED CAREER AWARENESS ACTIVITY:

Invite someone who is involved in the oil business to come to speak about his/her job.



materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, the students will be able to list by-products of crude oil and uses of each.

Developed by: Shirley Barnes
Beaverton School Dist.
Beaverton, OR

Added to by: Dan Grimes
EME

Burn samples of the following fabrics and record the results as indicated below:

(Possibly pieces of leather, silk or rubber could also be used.)

PRODUCT SAMPLES (1" squares)						
Results of Flame Test	Derived from Oil	Derived from Oil	Derived from Oil	Derived from Oil	Non-Oil	Non-Oil
	POLYESTER	STYROFOAM	PLASTIC (Baggie)	NYLON	COTTON	WOOL
Reaction to flame	Yellow flame; uneven, many little flames	Disintergrates rapidly; curls little flame until end; then flairs.	Melted, blackened when all melted, caught fire and burned like candle.	Melted - sticks to what it melts on.	Catches fire. Steady flame - orange & purple.	Burns like petroleum product. Hard to keep burning.
Odor	Mild	Smells like fried mushrooms Be cautious.	Mild	Smells a little like wood smoke	Like wood fire - sharp.	Mild-- wood smoke.
Smoke given off	About as much as a cigarette, blacker	Heavy black smoke; litte particles floating around.	A little white smoke.	White	No smoke while burning little white smoke after flame goes out.	Little white smoke
Ash residue	Brittle and black.	Black, hard, little, porous.	Browish - thick, not hardened, black specks.	Hard, solid, black.	Soft, like steel wool.	Brittle, porous, very light-breaks at a touch.

CONVERSIONS OF ENERGY

GOAL :

IT IS ESSENTIAL THAT EACH
PERSON KNOW THAT ENERGY CAN
BE CONVERTED FROM ONE FORM
TO ANOTHER.



ACTIVITY
DESCRIPTION PAGE
CONVERSION (4-6)

- Goal:** It is essential that each person know that energy can be converted from one form to another.
- Concept:** There are natural and artificial energy conversion systems subject to natural laws.
- Activity #1** "Light Energy to Heat Energy"
Grade level 5-6 Time: 1 - 30 minute
Science session
Given the opportunity, the student will observe that light energy can be converted to heat energy--an example of a natural energy conversion.
- Activity #2** "Water To Electricity"
Grade level 5-6 Time: 3 - 30 minute
Mathematics sessions and homework
Given the opportunity, the student will compute the amount of water (in liters) required to operate various electrical appliances for given periods of time.
- Activity #3** "My Radiometer"
Grade level 5-6 Time: 1 - 30 minute
Science session
Given the opportunity, the student will be able to observe an artificial version of a natural resource.
- Activity #4** "Hot Dog!!"
Grade level 4-5 Time: 6 - 30 minute
Science, Art sessions
Given the opportunity, the student will construct a device to cook a hot dog and will come up with speculations about how and why it works.
- Activity #5** "Wet - Windy and Steamy"
Grade level 4-5 Time: Several sessions
Science, Art
Given the opportunity, the student will construct a model water wheel, steam turbine and windmill, and will state how these might be used (full scale) to run a generator.
- Activity #6** "Password"
Grade level 6 Time: Variable - 30 minute
Language Arts sessions
Given the opportunity, the student will identify and use vocabulary words related to the topic of energy conversion (electrical) in a game situation.

ACTIVITY
DESCRIPTION PAGE
CONVERSION (4-6)

(continued)

- Concept: There are ethical, legal, aesthetic, social, political, economic, biological and physical benefits and problems associated with energy conversions.
- Activity #7** "Elements of a Good Life"
Grade level 5-6 Time: 5 - 30 minute
Social Studies sessions
Given the opportunity, the student will explore the city's needs for the various products of energy conversions through the development of a simulation game.
- Activity #8** "What Makes You Happy"
Grade level 5-6 Time: 4 - 30 minute
Social Studies, Art sessions
Given the opportunity, the student will construct a booklet showing pictures of various things they decide necessary to ensure a "good life" and compare these things to the effects they have upon the environment.
- Concept: All conversion processes use energy or lose heat energy.
- Activity #9** "Solar Collectors"
Grade level 6 Time: Several sessions
Science, Art
Given the opportunity, the student will be able to explain that solar collectors of different colors will convert solar energy to heat in different degrees.

title: "Light Energy to Heat Energy"



conversion



concept: There are natural and artificial energy conversion systems subject to natural laws.

objective: Given the opportunity, the student will observe that light energy can be converted to heat energy--an example of a natural energy conversion.

time: 1 - 30 minute session

subject matter area: Science

grade: 5-6

implementation:

- Activity:
1. Fasten two small thermometers to file cards. The cards will act as shades for the thermometers so that they will respond to the air temperature around them and not to the direct heating of the instruments.
 2. Place one thermometer in a jar and secure the lid. The other thermometer should be placed in a similar position next to the jar.
 3. A lamp should be placed within one or two feet of both thermometers, equally distant from both of them. The thermometers themselves should be behind the file cards in relation to the light source. If convenient, direct sunlight could (should) be used instead of the lamp.
 4. The temperature of both thermometers should be read initially and at five minute intervals over at least a 20 minute period.

materials:



- 2 small thermometers
- 1 clear quart jar with lid
- 2 file cards
- 1 lamp, approximately 150 watts



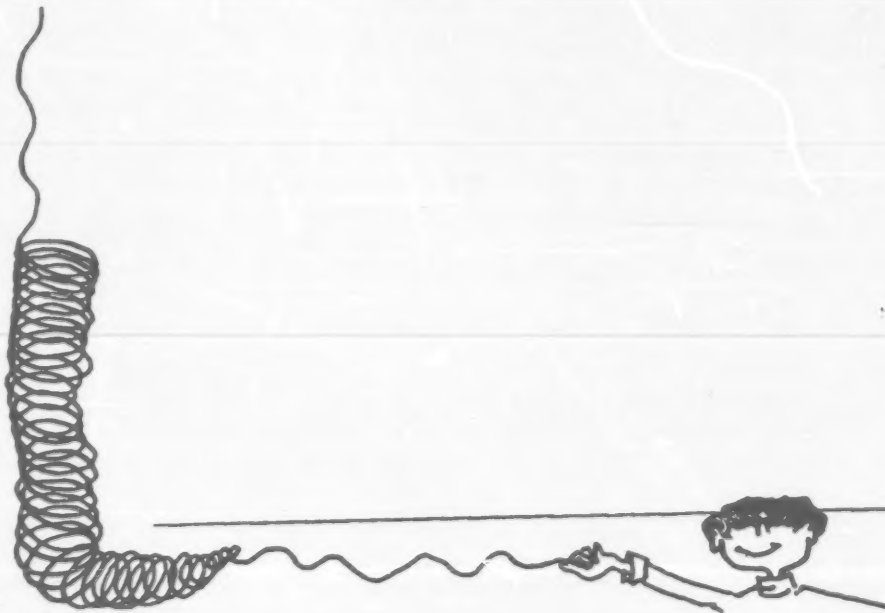
activity no. 1

Implementation:



Activities:
(cont.)

5. Questions:
- Which thermometer indicated the greater temperature changes?
 - When the jar is first opened, can you "feel" a difference when you reach in?
 - What role did the closed glass jar have in the changing of light to heat?
 - Can you think of some common useful examples of this experience on a larger scale?



materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity to observe two thermometers, one in a jar and one outside of a jar, the student will be able to measure and feel the difference of the amount of heat captured from a lamp.

Developed by: William Kintzley
Olympia, WA

Revised by: Dan Grimes, EME

title: "Water To Electricity"



conversion



concept: There are natural and artificial energy conversion systems subject to natural laws.

objective: Given the opportunity, the student will compute the amount of water (in liters) required to operate various electrical appliances for given periods of time.

time: 3 - 30 minute sessions and homework

subject matter area: Mathematics

grade: 5-6

implementation:

- Activity: 1. Introduction: It requires approximately 16 liters of water falling 30 meters to produce one watt hour electrical energy, or about 16,000 liters to produce one kilowatt hour of electricity.
- a. The above information has been computed in liters as it is felt that a liter can be visualized easily by a child and manipulated easily in the classroom. By using a liter measure, students may begin to get an idea of the actual volume of water used in generating electricity. (A liter measure may be made from a milk carton.)
2. The background information must be presented to students before they begin their computations. This might be accomplished through class discussion and actually working with liter containers of water. The first few computations may need to be done as a group.
- a. Prerequisite skills:
- Ability to read and understand a bar graph.
 - Ability to add and subtract with regrouping.
 - Ability to multiply by two-digit numbers.

materials:



Bar graph showing average wattage of various home electrical appliances (attached).
Explanation of, "How to Read Your Meter" (attached).
Chart, average KWH use and hours of operation per year for appliances (attached).



Implementation:

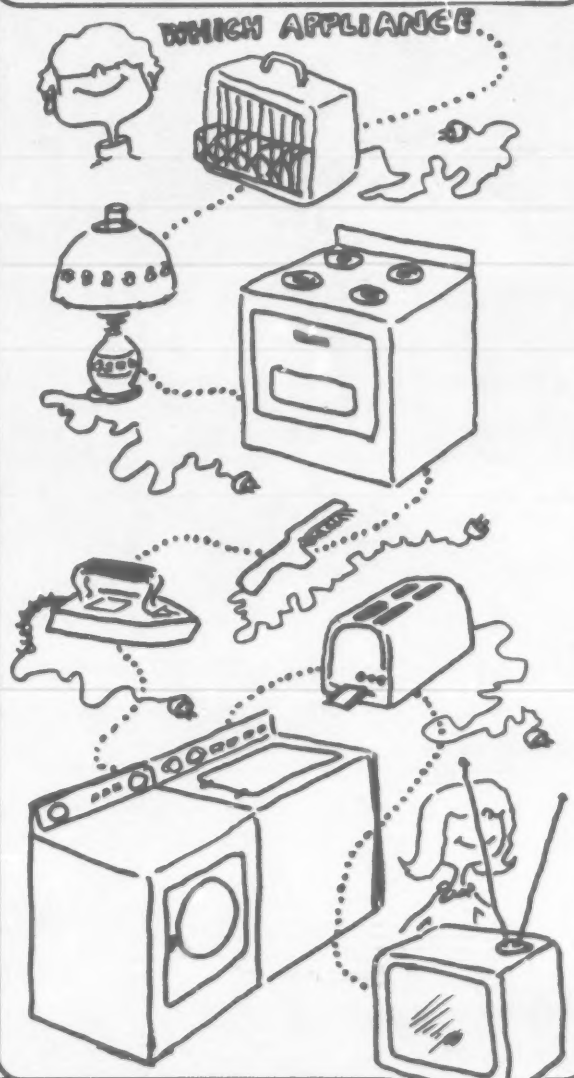
Activities:
(cont.)

3. Procedure - Students are to study the bar graph on the attached sheet and answer the following questions:
- Which appliance shown on the graph requires the greatest amount of electricity for its operation?
 - Which appliance requires the least amount of electricity?
 - Which appliance is used most often in your home?
 - Which appliance do you consider to be most important to your family?
 - Which appliance do you think your family could do without?
 - How many watts of electrical energy are required to operate the electric can opener? How many liters of water would have to pass over a 30 meter high dam to operate the can opener for one hour? Two hours? Three hours?

 $16 \text{ liters} \times 10 \text{ watts} = 160 \text{ liters of water}$
 $2 (16) \text{ liters} \times 10 \text{ watts} = 320 \text{ liters of water}$
 - How many watts of electrical energy are required to operate the clothes dryer? How many liters of water must pass over the dam to operate the dryer for one hour?

 $16 \times 4600 = 73,600 \text{ liters of water}$

 For three hours?
 - Compute the equivalent number of liters of water required to operate each of the other appliances for one hour.
 - Assume that all of the appliances shown on the graph were being used in your house at the same time. How many liters of water would be required to produce electricity to operate the appliances for one hour?

materials:

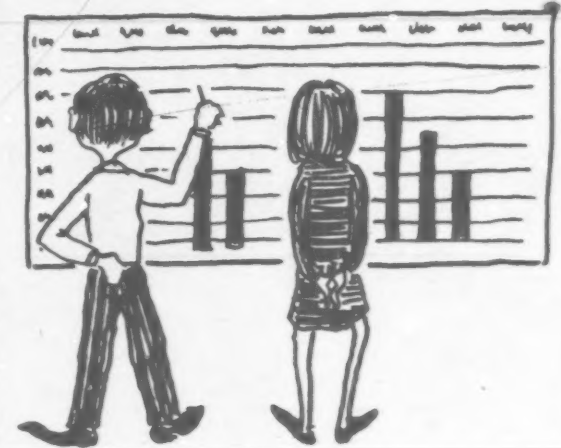
implementation:



Activities:
(cont.)

4. In order to complete this part of the activity, the student must learn how to read an electric meter.
5. The students will then complete the following activities:
 - a. Go home after school and read your utility meter. Record the number of kilowatt hours shown.
 - b. Keep a record of your meter for a week, reading and recording the KWH at the same time each day.
 - c. Compute the number of KWH used by your family each day of that week, and record it on a bar graph.
 - d. On which day did your family use the most electricity? Why?
 - e. On which day did your family use the least electricity? Why?
 - f. How many KWH of electricity were used by your family during the entire week?
 - g. Approximately how many liters of water were required to produce the electricity for your family for that week?
6. Suggestions: The students might try another week of reading the meter, this time after the family has discussed ways of conserving electricity at home. Compare the amount of electricity used during that week with the amount used the prior week. Compare the equivalent number of liters of water.

materials:

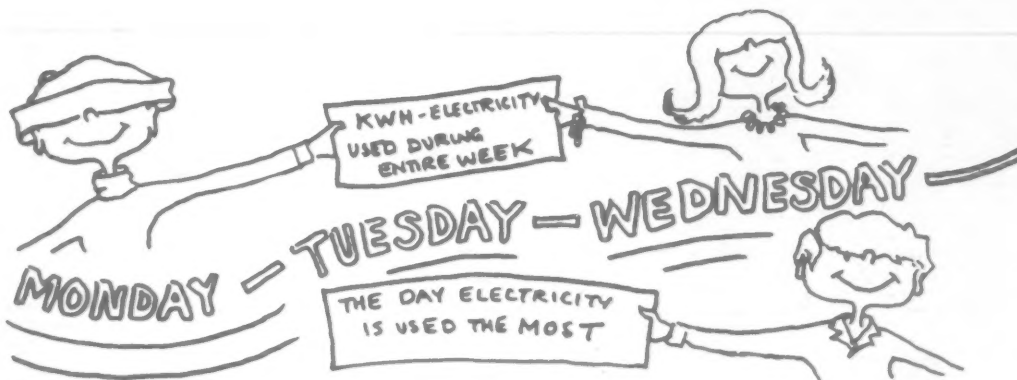


implementation:



SUGGESTED CAREER AWARENESS ACTIVITY:

Invite a local utility worker to class to explain his/her job and how water is converted to electricity.



materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, the student will be able to compute the amount of falling water it takes to produce enough electricity to operate home appliances.



Developed by: Janet K. Boston
Olympia, WA

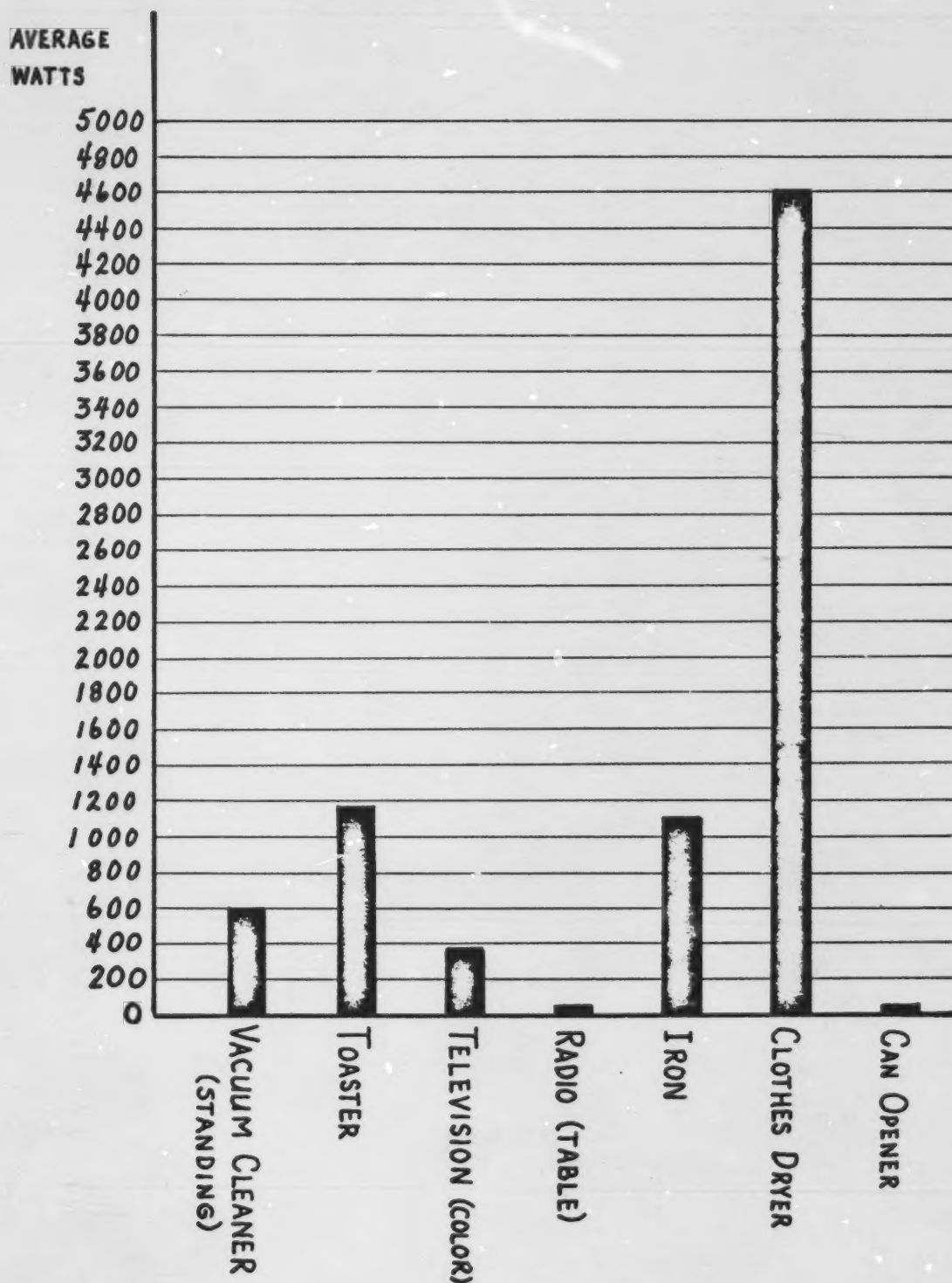
Revised by: Dan Grimes
EME

Appliance	Average Watts	Hours of Operation Per Year	KWH Use
Heater			
Portable	1000	1080	1080
Radiant	1270	135	170
Heating Pad	65	120	8
Hot Plate	1250	72	90
Iron	1100	145	160
Ironer	1500	145	222
Lawnmower	1000	130	100
Lighting (varies with size of home and living habits)			1000
Night Light	10	2900	29
Post Light (Photo Cell)	100	4200	420
Projector			
Slide	500	50	25
Motion Picture	700	50	35
Radio			
Console	75	1400	125
Table	50	1400	70
Radio-phonograph	110	1000	110
Range	12000	100	1200
Self Cleaning Oven	4000	50	200
Razor	15	60	1
Record Player			
Console	160	300	50
Table	75	300	25
Recorder	100	100	10
Refrigerator - 12 cu ft.			
Standard	240	3125	750
Frost Free	320	3800	1220
Refrigerator-Freezer - 14 cu. ft.			
Standard	325	3540	1450
Frost Free	360	5150	1850
Roaster	1320	360	475
Rotisserie	1400	360	500
Sewing Machine	100	120	12
Sun Lamp	300	50	15
Television			
Black & White	240	1500	360
Color	350	1500	525
Toaster	1150	48	55
Toothbrush	5	10	<u>1/</u>
Vacuum Cleaner			
Portable	210	60	13
Standard	600	120	70
Vibrator	40	50	2
Waffle Iron	1100	24	26
Washer <u>2/</u>			
Automatic	500	200	100
Nonautomatic	285	200	75
Water Heater (varies considerably with clothes washing and bathing habits)			4800-9600

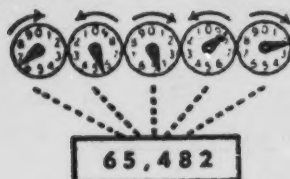
1/ Less than 1 kwh

2/ Does not include electricity to heat water

AVERAGE WATTAGE OF VARIOUS HOME ELECTRICAL APPLIANCES



HOW TO READ YOUR METER



Your electric meter is a precise, additive device which directly records the units of electricity (Kilowatt hours) used in your home. Each meter dial records one-tenth of the dial on its left; i.e., units, tens, hundreds, thousands and ten-thousands.

As an example, the above dials read 65,482. An electric bill would be determined by subtracting the previous reading from this reading to find the net kilowatt hours consumed between reading dates.

To read a meter, start with the right hand dial and read left and write the numbers down in the same order. The pointers on the first, third, and fifth dials move clockwise and counterclockwise on the second and fourth. If the pointer on the dial is between numbers, record the smaller number. If the pointer is directly on a number, read the next smaller number unless the pointer on the dial at its right has passed zero.

title: "My Radiometer"



conversion



concept: There are natural and artificial energy conversion systems subject to natural laws.

objective: Given the opportunity, the student will be able to observe an artificial version of a natural resource.

time: 1 - 30 minute session

subject matter area: Science

grade: 5-6

implementation:

Activity: 1. Below is a list of the procedures to follow to complete this lesson:

- a. Set both a radiometer and a lamp on a level table or counter approximately 60 cm from each other. Focusing the lamp on the radiometer, turn on the light and observe the action of the radiometer.
- b. Next, vary the distance between the lamp and the radiometer from 30 cm to 1 m and notice any variation in the action of the radiometer.
- c. With the lamp approximately 45 cm away from the radiometer, alternately hold and take away an opaque piece of paper in front of the lamp. Note the effects of the speed and completeness with which you block the light on the radiometer.

NOTE: If it is convenient and conditions are suitable, much of the above procedures can be done in sunlight, which may be better in terms of appreciating the concepts and related ideas.

materials:



- 1 Radiometer
- 1 Electric lamp, approximately 150 W
- 1 Opaque sheet of paper



activity no. 3

implementation:



Activities:

(cont.)

2. Questions for class discussion:

- What effect does intensity of light (distance and/or shading) have on the radiometer?
- What are some ways a radiometer could be used as an energy source (or a machine for doing work) itself? As a type of solar switch?

SUGGESTED CAREER AWARENESS ACTIVITY:

Students role-play being a science design engineer by drawing an illustration of how the radiometer concept could be used on a large scale to produce electrical power. Allow students to be creative. Have them share their illustration with others.



materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity to observe a radiometer, the student will be able to explain what effect light/heat has on the device.

Developed by: William Kintzley
Olympia, WA

Revised by: Dan Grimes
EME

title: "Hot Dog!!"



conversion



concept: There are natural and artificial energy conversion systems subject to natural laws.

objective: Given the opportunity, the student will construct a device to cook a hot dog and will come up with speculations about how and why it works.

time: 6 - 30 minute sessions

subject matter area: Science, Art

grade: 4-5

implementation:

- Activity: 1. Give each student or pair of students the materials needed to construct the hot dog cooker, and ask them to construct a device that they think could be used to cook a hot dog. Tell them that when the cookers are finished, the class will test them to see which one works the best.

NOTE --BE SURE that children do not try out their own devices without supervision. A short discussion of the dangers of electric current might be needed before students begin to work.

2. After the cookers have been constructed, test them and have children decide which works best.
3. Follow the testing with a class discussion of what they have observed. Some of the discussion questions might be as follows:
- What did you observe?
(The hot dog acts as a conductor of electricity. It conducts electricity flowing through the nails and becomes hot. It begins to sag and swell and eventually cooks.)
 - How do you think the hot dog was cooked?
(Electrical energy is converted to heat energy.)

materials:



1. Block of wood, about 4 inches square
2. Two small pieces of wood, each about 4 inches long and 1 inch wide
3. Two large nails; four small nails
4. Electrical cord
5. Hot dog

See sheet describing the construction of the hot dog cooker.

implementation:

Activities:
(cont.)

- c. Review a definition of energy with the class. Ask them to name other kinds of energy they know, i.e., energy from the sun, wind, fire, nuclear, etc.
- d. Involve the class in a discussion of energy and how it works for us. What can electricity do?

They may come up with such things as producing heat, light, running motors, making sounds and pictures (TV).

- e. Ask the class where the energy came from that cooked the hot dog.

4. Suggestions:

- a. Answers to the questions above are given for the teacher's benefit. Since this activity is a preface to further activities in electricity, students should not be expected to know the answers, and should not be told them by the teacher. The purpose of this activity is to stimulate the interest of the students and hopefully motivate them to further explorations with electricity. At the end of the module on electrical energy, the students should be able to answer all of the above questions independently.
- b. Some experimentation with the cookers may be necessary in cooking the hot dog. The hot dog may need to be reversed during cooking if one nail seems to be putting out more heat.
- c. Caution should be used in using this equipment. The cord should always be unplugged when putting on or removing a hot dog or when handling the cooker for any reason.

materials:

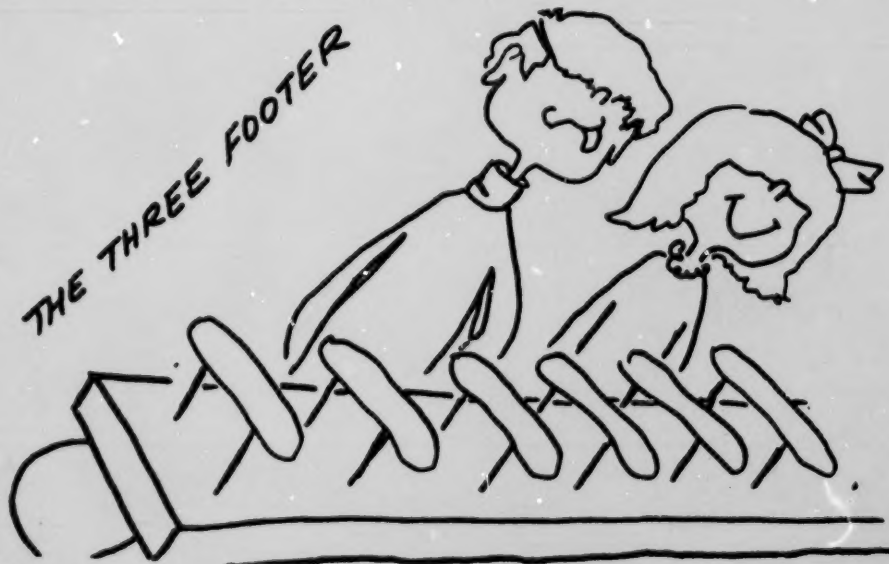
implementation:

Activities:
(cont.)

- d. Hot dogs may be cooked for the whole class and eaten if desired. This would of course be very time consuming with a single cooker, so several might be used, or the class might like to construct a multiple cooker using a longer piece of wood, adding more nails, and wiring these nails into the system.

SUGGESTED CAREER AWARENESS ACTIVITY:

Have the students role-play that they are a salesperson and they need to develop a sales advertising plan to sell their hot dog cooker to others. (e.g., posters-speeches-demonstrations-etc.) Discuss with students their feelings and reactions to sales after they role-play. (Is the product a good one? Is the product easy to sell?)

**materials:**SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, the student will be able to construct a hot dog cooker and realize that electrical energy has to be converted to heat energy to cook the hot dog.



Developed by: Janet K. Boston
Olympia, WA

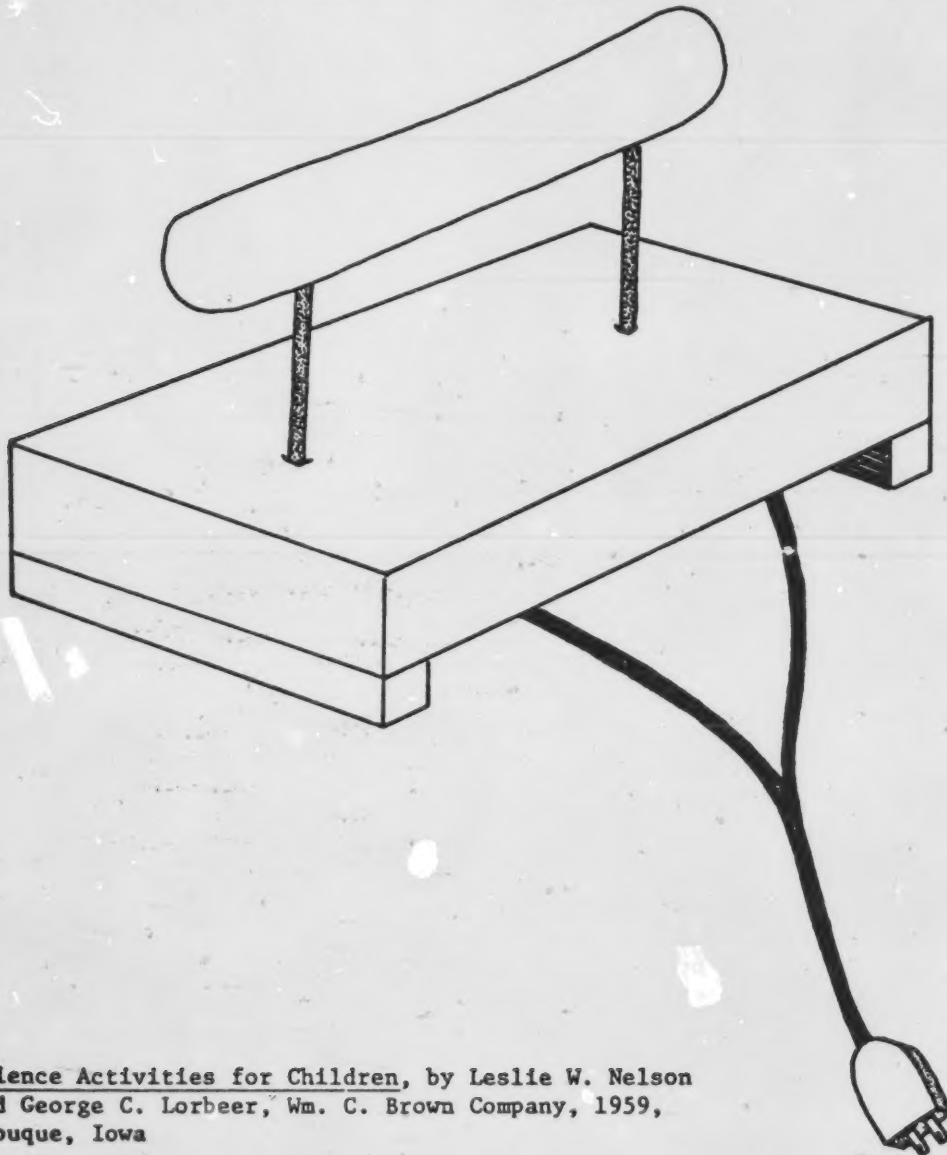
Revised by: Dan Grimes
EME

ASSEMBLING THE HOT DOG COOKER:* (See materials)

- 1) Nail the two small pieces of wood to the wood block. (See sketch)
- 2) Nail two large nails through the large block as shown, leaving about 1/4 inch of head at the bottom of the block.
- 3) Wrap the ends of each wire around the heads of the nails and drive nails into the block to secure the wires.

PROCEDURE:

Stick the hot dog onto the nails and plug in the electrical cord to a wall outlet. Allow the class to observe as the hot dog "cooks".



*Science Activities for Children, by Leslie W. Nelson and George C. Lorbeer, Wm. C. Brown Company, 1959, Dubuque, Iowa

title: "Wet - Windy and Steamy"



conversion



concept: There are natural and artificial energy conversion systems subject to natural laws.

objective: Given the opportunity, the student will construct a model water wheel, steam turbine and windmill, and will state how these might be used (full scale) to run a generator.

time: Several sessions

subject matter area: Science, Art

grade: 4-5

implementation:

Activity:
(Background)

The activities in this module are in two parts. The first part is in the form of a learning package that is to be completed independently by each student. The second part of the module is teacher directed and may be accomplished as a whole class or small group activity.

After completion of the learning package, the teacher should conduct a discussion of their findings. Some suggestions for this discussion are as follows:

1. Review with the class the findings of their experiments with water, steam and moving air. Ask if any came up with ideas for how water or steam might be used to generate electricity. Allow time for discussion. Ideas by children can be put on the board for the class to discuss and evaluate.
2. Ask for volunteers to help with an experiment. One child will hold a hose over a tub or sink and several other children will be needed to hold their water wheels beneath the stream of water.
 - a. First experiment with the height of the water. Ask children to observe closely while you place the water wheel in different places under the falling water. Does it seem to make a difference in the speed that the wheel turns?

materials:

Individual learning packages



NOTE: Materials are listed for a single student for each experiment. Enough of each of the materials should be made available to allow each child to obtain the materials as he needs them to perform the various activities.

1. The power of water
 - a. Light weight tagboard or one side of a $\frac{1}{2}$ gallon milk carton
 - b. Scissors
 - c. Toothpick or match
 - d. Button
 - e. Thread
2. The power of steam
 - a. The cover of a round box, such as an oatmeal box
 - b. Heavy duty aluminum foil (a piece about 6 inches wide and 12 inches long)

implementation:**Activities:**
(cont.)

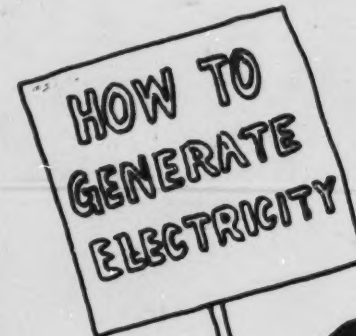
- c. Discuss with the children the energy conversions that take place in the water and steam experiments. Remind them that the purpose of these experiments was to come up with a way to generate electricity. They should realize that in order to generate electricity they must convert energy from one form to another. For example, in the steam experiment there are several conversions that take place:
- electrical to thermal (the stove heats the water)
 - thermal to physical (water boils to steam)
 - physical to mechanical (steam turns the turbine)
 - mechanical to electrical (turbine runs generator)

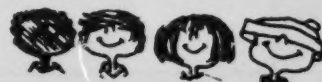
Talk about the energy that must be put into the system in order to come up with electricity.

4. Discuss the moving air experiments. Ask children to compare this method with each of the others. What might be possible advantages?

5. Suggestions:

- a. Filmstrips and films showing different kinds of electric plants and how they work would be helpful to clarify these concepts for children.
- b. Field trips to visit a hydro-electric plant and a coal-fired electric plant could be incorporated if feasible.
- c. Vocabulary used in the learning package may need to be introduced and reviewed by the teacher.

materials:

implementation:**Activities:**
(cont.)

- b. Next, ask children whether they think we are using all of the power of the water to turn the water wheels. Could we turn more than one?
 - c. Have volunteers add their water wheels one by one to the stream of water to see how many wheels they can turn with the water. Does the speed of the wheels turning change by adding more wheels?
 - d. When you have as many wheels turning as possible, ask children if they are now using all of the power available. How do they know?
 - e. Ask: What happens to the water that is not being used to turn the wheels? Where does it go? Is there any way that this water can be used again? How?
 - f. Ask how many children have visited a dam where a power plant is located. What happens to the water once it goes over the dam?
3. Heat water in a tea kettle and use the same procedure as with the water wheels, using the steam from the kettle and the model turbines built by the children in their learning package activities.
- a. Ask: Are we using all of the steam available to turn the turbines? How do you know? You might have a child hold his/her hand above the turbines to see if he/she can feel steam on his/her hand as evidence that steam is escaping.
 - b. Ask: Is the wasted steam wasted energy? What happens to the steam that is left over? Is there any way that we can use this steam to do work for us? Can we re-use the steam? Is there any other kind of energy produced that might be used? (heat) How might it be used? Do you think that either the steam or the heat have any effect on the environment?

materials:

- c. A snap fastener, the kind without a hole in the middle
- d. A needle
- e. A pencil with an eraser
- f. An empty thread spool
- g. A stapler
- h. A teakettle or pan with a lid
- i. A stove or burner

3. The power of wind

- a. The turbine made in experiment #2

Whole class activity

- a. Faucet and hose if available; if not use a large pitcher of water
- b. Tub or receptacle to catch falling water
- c. Burner or stove
- d. Tea kettle or pan with lid
- e. Model water wheels and steam turbines made by students in above experiments



implementation:



Activities:
(cont.)

SUGGESTED CAREER AWARENESS ACTIVITY:

Invite a local electrical utility person to class or someone who has information about steam and wind power generation to demonstrate how these sources of energy might be used on a large scale.

**WHAT OTHER WAY IS THERE
TO MAKE ELECTRICITY**

materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity to successfully complete each of the activities in the module, including the written answers to questions included in the package, and class discussion, the student should be able to obtain the stated objective.



Developed by: Janet K. Boston
Olympia, WA

Revised by: Dan Grimes
EME

ELECTRICAL CONVERSION ALTERNATIVES

We have learned that there are two kinds of electricity: static electricity and current electricity.

We have seen two ways of producing an electric current:

1. Using stored electricity as with a battery or cell.
2. By generating electricity with a generator.

We have used both a battery and a generator to supply an electric current to do work for us. But we have produced only a very small amount of electricity with our simple experiments. We know that it takes many, many times more electricity to do the work that electricity does in our homes. Imagine the amount of electricity needed to supply all of the homes and industries in your town or city! Where does all of this electricity come from?

You probably know that most of the electricity we use is brought to our homes by power lines which carry electric current. Where does the electric current come from? It comes from huge power plants where electricity is generated in large amounts for our use. You know that generated electricity requires a generator, and that a generator needs a magnet, a coil and that either the magnet or the coil must move.

When you generated electricity with a hand generator you used the energy of your muscles to turn the crank. But the generators in a power station are enormous, with metal cases that cover the great coils of wire and the powerful magnets. How are these generators turned?

Here are some simple activities that you can do to see some ways that generators might be turned in a huge power station:

1. The power of water. Refer to the Materials Section for a list of needed items. Follow the below listed directions:
 - a. Cut a circle about 10 cm in diameter from the tagboard.
 - b. Make 2 lines on the circle, as show in the sketch.
 - c. Cut part way down the lines and bend the flaps.

d. Sharpen the toothpick or match at both ends, then stick it through the center of the circle.

e. Hold the wheel lightly by the ends of the toothpick in one hand so that the points of the toothpick are between your thumb and middle finger.

f. Hold the wheel under a faucet and slowly turn on the water. What happens to the wheel?

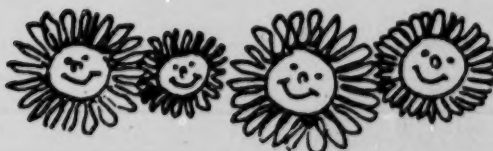
g. Now turn on the water full force. Watch the wheel. Where did it get the power to turn?

h. Where did the water get the power to turn the wheel?

i. Now you can make your water wheel do some work for you by tying a button to one end of a piece of thread and tying the other end of the thread to the toothpick. Now hold the wheel under the running water. What happens to the button and thread?

j. Using what you learned about the power of falling water in this experiment, describe a way that water might be used to generate electricity.

2. The power of steam. Refer to the Materials Section for a list of needed items. Follow the below listed directions:
- Cut the foil into eight pieces, each 7.5 cm long and 5 cm wide. Then fold each piece in half so that it is 7.5 cm long and 2.5 cm wide.
 - Staple each piece to the box cover (see sketch).
 - Push the eye end of the needle into the eraser of the pencil.
 - Put the box cover on the point of the needle. Experiment until you find the place where the cover hangs straight and even. Make a tiny hole at this place.
 - Push the bottom half of the snap fastener into this hole.
 - Put the point of the pencil into the hole in the spool.
 - Rest the box cover on the point of the needle.



- Put some water in a teakettle or pan with a lid and heat it until it boils. (If you are using a pan with a lid, place the lid slightly off center so that the steam pushes out strongly on one side of the pan.)
- Hold the device you made by the spool and bring it near the steam pouring from the kettle. What happens?

j. Where does the wheel get the power to turn?

k. Where does the steam come from?

l. Where did the water get the heat that made it boil to make the steam?

m. Where did the heat come from? What was the energy source used to heat the water?

n. Using what you have learned about the power of steam, describe a way that steam might be used to generate electricity.

3. The power of wind. Use the device you made in the second experiment. Follow the below listed directions:

a. Hold your miniature turbine in one hand and blow on it gently. What happens?

b. Blow hard on the wheel. What happens?

c. What makes the wheel turn? Where does this power come from?

d. Using what you have learned about the power of moving air, describe a way that wind might be used to generate electricity.

title: "Password"



conversion



concept: There are natural and artificial energy conversion systems subject to natural laws.

objective: Given the opportunity, the student will identify and use vocabulary words related to the topic of energy conversion (electrical) in a game situation.

time: Variable -
30 minute sessions

subject matter area: Language Arts

grade: 6

implementation:

- Activity:
1. Divide the class into two groups of approximately equal ability. Choose one student from each team to give clues and have them sit at the front of the room. This game is played like the TV game "Password," except that each clue giver will be giving clues to teammates rather than to one partner.
 2. You may want to use the list of suggested words included, or add you own. (Students should be familiar with the words before the game is played.)
 3. How the game is played:
 - a. Each of the clue givers is shown the password.
 - b. The clue-givers then give clues alternately to their teams as to the identity of the password. Only one-word clues are allowed.
 - c. After giving a clue, the clue giver chooses someone on the team to guess what the password is. If that team member guesses the correct word, the team scores, and you begin a new round using a new password.
 - d. If the team member guesses incorrectly, the turn goes to the other clue giver, who gives a new clue and chooses someone from the team to guess.

materials:

A list of vocabulary words, a suggested list is included.



implementation:



Activities: (cont.)

- e. After the word has been guessed correctly by one team or the other, the new word goes first to the clue giver who did not start the previous round.
- f. Scoring is as follows:
 - 10 pts. for the team guessing the word correctly on the first clue.
 - 9 pts. if the correct word is guessed on the second clue.
 - 8 pts. if the team guesses the password after hearing the third clue, etc.
- g. New clues should be chosen from each team after every three or four rounds have been played.

Optional Activities:

- A. Have the students take part in a spelling bee that uses words about energy; potential -- kinetic heat -- light -- etc. How many of these words can you define?
- B. The teacher selects five (5) words from the attached list and includes them in the students spelling list for the week. Have the students define as well as practice spelling each word until the total list is completed.

materials:



SUGGESTED ASSESSMENT PROCEDURE:

Evaluation of this activity is somewhat subjective on the teacher's part. Students may be evaluated on:

- Participation in the game by attempting to guess the password.
- Ability to give meaningful one-word clues to the identity of the password.
- Ability to associate the clues and come up with the correct word.
- General familiarity and comprehension of the vocabulary words used.

Developed by: Janet K. Boston
Olympia, WA

Revised by: Dan Grimes
EME



activities



POSSIBLE WORDS TO BE USED IN THE GAME "PASSWORD"

turbine

steam

battery

generator

generate

electricity

energy

conversion

convert

source

power

current

static

experiment

magnet

circuit

wind

water

heat

light

quantity

available

friction

detect

detector

insulated

instrument

coil

volt

watt

kilowatt

electron

neutron

charge

positive

negative

produce

reaction

compass

appliances

conserve

waste

title: "Elements of a Good Life"



conversion



concept: There are ethical, legal, aesthetic, social, political, economic, biological and physical benefits and problems associated with energy conversions.

objective: Given the opportunity, the student will explore the city's needs for the various products of energy conversions through the development of a simulation game.

time: 5 - 30 minute sessions

subject matter area: Social Studies

grade: 5-6

implementation:

- Activity:
1. Ask the students to work individually and list as many energy based activities and products they can think of which are used on a daily basis. (10 minutes)
 2. Provide each one of the students with the background information for "Elements of a Good Life" and ask them to read it:

BACKGROUND: ELEMENTS OF A GOOD LIFE

To insure a good life in our community the people basically strive to achieve the same goals. The goals range from making money, owning various material goods, having an adequate amount of leisure time and being satisfied with one's work, to maintaining good health and enjoying recreational activities.

- a. As a class, list in order of importance the goals which constitute the elements of a good life.
- b. As a class, categorize the activities and products listed in activity #1 according to the elements of a good life as described in activity #2.

materials:



Paper and pencils
Individual sheets containing the background for "Elements of a Good Life"



Implementation:**Activities:**
(cont.)

- c. Definition of the problem:
- The Board of Commissioners of your city has announced that due to the misuse of energy and its effect upon the environment, certain activities and products must be eliminated. They have suggested that the city's people be asked to do without various products and restrain from certain activities so that decisions could be made as to which products and activities could be eliminated.
 - Divide the class into groups of five people, each group to represent one of the five goals of a good life. Each group should have a list of the activities or products which they decided they used for the goal they represent. Each group must decide to stop using either a product or activity from their list for one week. They should try to not use this at school or at home. This must be an important product or activity.

Teacher note: Check to make sure the product or activity is of importance, otherwise avoiding its use will be of little significance.

- d. During the week, the students may want to keep records of their feelings about not using the product. After one week, the groups should meet again to discuss the following questions.
- What form(s) of energy are needed to produce this product or carry out this activity?
 - What discomfort, if any, did you feel with having to do without this product or activity for one week?
 - Name the possible advantages to the environment if this product or activity were eliminated.

materials:

implementation:



Activities (cont.)

- e. One person from each group should be selected to act as a Commissioner on the Board. The Commissioners then meet to establish a list of priorities through which products and activities are to be eliminated.
Possible priorities are:
- How does the disuse of the product or activity affect:
Physical health?
Mental health?
Energy consumption and mis-use?
- f. The five groups (minus their commissioner) meet and elect one person from each group who will appear before the Board of Commissioners to report their findings. Each group should prepare a three minute (or shorter) presentation.
- g. After the presentations the Board will have a short recess to decide from the cases presented which products or activities will be eliminated (5 minutes). They will then report their findings and reasons to the city people.

SUGGESTED CAREER AWARENESS ACTIVITY:

Role playing the City Commissioner.

materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity to participate in a simulation game, the student will be able to understand the decision-making processes involved in planning for a "good life."



Developed by: Patricia Bunger
Olympia, WA

Revised by: Dan Grimes
EME

title: "What Makes You Happy"



conversion



concept: There are ethical, legal, aesthetic, social, political, economic, biological and physical benefits and problems associated with energy conversions.

objective: Given the opportunity, the student will construct a booklet showing pictures of various things they decide necessary to ensure a "good life" and compare these things to the effects they have upon the environment.

time: 4 - 30 minute sessions

subject matter area: Social Studies, Art

grade: 5-6

implementation:

- Activity:
1. Class discusses what constitutes a good life, what things they want out of life. What makes you happy?
 2. Assign the construction of a booklet, leaving every other page blank. On the left side of the page, the students paste a picture or draw a picture of the item that they think makes a good life.
 3. After the booklet is finished, discuss and show the booklets to the others. This shows others the individuality of each of them. Hand the booklets back to their owners and have them list or explain on the right side of the page how this item affects the environment. Does it help the environment, or pollute it?
 4. After the individual has completed this part of the assignment, pass the books out randomly to the students so that every child receives another child's book. Then tell them to add to the right hand side of the page, any other effects upon the environment that the original author may have overlooked.

materials:

Material to construct a booklet.
Drawing materials
Old magazines



implementation:



Activities:
(cont.)

5. When this has been done hold a class discussion asking:
 - a. What does "values" mean to you?
 - b. What values are beneficial to our environment?
 - c. Which values are not beneficial to our environment?
 - d. Should people's values include this idea: The value of a process or product must be to create the greatest social good?



materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity to construct a booklet on the elements of a "good life," the student will gain an understanding of the environmental trade-offs involved in making wise energy use decisions.

Developed by: Patricia Bunger
Olympia, WA

Revised by: Dan Grimes
EME

title: "Solar Collectors"



conversion



concept: All conversion processes use energy or lose heat energy.

objective: Given the opportunity, the student will be able to explain that solar collectors of different colors will convert solar energy to heat in different degrees.

time: Several sessions

subject matter area: Science, Art

grade: 6

implementation:

- Activity:
1. In small groups have students select a color from those available and paint a small coffee can.
 2. Fill each coffee can half full of water and insert a thermometer to measure the temperature of the water. Place cans in a place where sunlight will hit them for several hours each day. Measure starting temperatures.
 3. Student groups will then prepare charts to plot temperature against time of day at 30 minute intervals.
 4. The students will be able to make some group decisions about which color is best for collecting heat by doing the above three activities over a five or six day period.
 5. Repeat the above using other colors of paint.

materials:

Various colors of paint
Several coffee cans
Several thermometers - one for each can
Paper
Pencil - possible marking pencils of different colors
Ruler



implementation:



SUGGESTED CAREER AWARENESS ACTIVITY:

Invite a speaker who works in the area of solar energy to speak to the class about his/her job.



materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given temperature charts, the student will be able to list conclusions indicating which colors are better conductors of heat.

Developed by: William Jacob
Olympia, WA

Revised by: Dan Grimes
EME

IMPACTS OF ENERGY

GOAL:

IT IS ESSENTIAL THAT EACH PERSON
KNOW HOW PEOPLE'S USE OF ENERGY
CREATES AN IMPACT ON ENVIRONMENTAL
AND ECONOMIC SYSTEMS.



ACTIVITY
DESCRIPTION PAGE
IMPACTS (4-6)

Goal: It is essential that each person know how people's use of energy creates an impact on the environmental and economic systems.

Concept: Various energy sources have differing impacts on the environment.

Activity #1 "The Automobile"
Grade level 5-6 Time: Several sessions
Science, Mathematics
Given the opportunity, the student will explore the by-products of various conversions and their effects upon our environment by testing the amount of pollution coming from car exhaust, comparing the results of one to seven days.

Activity #2 "The Air Yells, 'Help!'"
Grade level 5-6 Time: Several sessions
Science, Social Studies
Given the opportunity, the student will trace the development of transportation in the U.S. from its earliest forms to present day and list environmental impacts of modern transportation.

Activity #3 "To Fertilize or Not To Fertilize - That Is The Question"
Grade level 4-5 Time: Several sessions
Social Studies
Given the opportunity, the student will determine that people can modify the soil by adding fertilizer.

Concept: Efforts to regulate energy producers and users require energy, economic allocation and political effort.

Activity #4 "Take A Field Trip"
Grade level 6 Time: 2 - 30 minute
Social Studies sessions
Given the opportunity, the student will study local zoning laws considering the factors of aesthetics, convenience and energy requirements.

ACTIVITY
DESCRIPTION PAGE

IMPACTS (4-6) (continued)

Concept: Conflicts over ecologically sound practices and aesthetic judgments will involve trade-offs if they are to be resolved.

Activity #5 "The Kool-Aid Stand"
Grade level 4-5 Time: 4 - 30 minute
Social Studies, Science sessions
Art, Language Arts, Mathematics

Given the opportunity, the student will prepare an Environmental Impact Statement for the purpose of starting a hypothetical business (Kool-Aid stand business).

Activity #6 "Waste Paper Study"
Grade level 4-5 Time: Less than 10
Mathematics minute sessions

Given the opportunity, the students will collect the trash from the classroom each day for a period of four weeks in a garbage sack, weighing the bag each afternoon.

Activity #7 "You and Your Environment"
Grade level 5 Time: Several sessions
Mathematics, Language Arts,
Science, Social Studies

Given the opportunity, the student will determine methods already being used in school and community to clean up the environment and will become aware of other possible environmental activities which could be undertaken by school or community.

Concept: There are many ways to conserve energy.

Activity #8 "Meter Reading"
Grade level 6 Time: 4 - 30 minute
Mathematics sessions

Given the opportunity, the student will list ways by which energy may be conserved at home, school, and in the broader community.

Concept: Industrial societies have a greater impact on the environment than do agrarian societies.

Activity #9 "A Trip To A Factory"
Grade level 5 Time: Varied (field trip)
Social Studies

Given the opportunity, the student will be exposed to the workings of a large company and its concerns and obligations for cleanliness and environmental impact.

ACTIVITY
DESCRIPTION PAGE
IMPACTS (4-6) (continued)

- Activity #10 "Trains or Trucks"
Grade level 4-5 Time: Varied
Mathematics, Social Studies
- Given the opportunity, the student will assess the relative aesthetic effects of railroad vs. freeway transportation.
- Activity #11 "The Last Frontier"
Grade level 4-5 Time: Several sessions
Social Studies, Art, Mathematics
- Given the opportunity, the student will be able to list harmful and beneficial effects upon a frontier town resulting from the introduction of a railroad.

Concept: Some uses of energy are more threatening to ecosystems than are others.

- Activity #12 "Bagasse"
Grade level 5-6 Time: 5 - 30 minute
Art, Science, Social Studies sessions
- Given the opportunity, the student will be able to explain how bagasse (sugar cane waste) is being used as a clean energy source rather than a pollutant, and to list other industries which are beginning to change wastes into useful energy sources.

Concept: The use or non-use of any energy source requires environmental trade-offs.

- Activity #13 "Starting A Business"
Grade level 6 Time: 4 - 30 minute
Social Studies, Language Arts sessions
Health, Art
- Given the opportunity to outline a hypothetical business, the students will determine that the decisions they make about environmental trade-offs are based on internalized values.

- Activity #14 "Simulated Community"
Grade level 4-6 Time: Several days,
Mathematics, Social Studies, on-going
Art, Science
- Given the opportunity, the student will be able to construct a simulated mini-community that creates an ever growing need for energy conservation.

ACTIVITY
DESCRIPTION PAGE

IMPACTS (4-6) (continued)

Activity #15 "This Land Is My Land!!!"
Grade level 5-6 Time: 4 - 30 minute
Social Studies, Art sessions

Given the opportunity, the student will recognize that land values and land usage were contributing causes of the Civil War in the United States.

Activity #16 "In The Year 2500?"
Grade level 5-6 Time: 6 - 30 minute
Social Studies, Art, sessions
Language Arts

- 1) The student should be able to compare and evaluate benefits received from energy use with the environmental consequences arising from alterations necessary to produce it.
- 2) The student should recognize the varying ways that people affect the quality and structure of their environment.

Concept: Energy extraction and use alters original environmental conditions.

Activity #17 "Land Pollution"
Grade level 5-6 Time: Several sessions
Language Arts, Science,
Social Studies

Given the opportunity, the student will be able to become aware of the following three sources of human-made land pollutants when given the background information through research and discussion: 1) Metals (vis., iron ore), 2) Wood (plants) and 3) All others (petroleum, etc.).

Activity #18 "Water Pollution"
Grade level 5-6 Time: Several sessions
Language Arts, Social Studies

Given the opportunity, the student will recognize that energy production plants affect environmental conditions.

title: "The Automobile"



impacts



concept: Various energy sources have differing impacts on the environment.

objective: Given the opportunity, the student will explore the by-products of various conversions and their effects upon our environment by testing the amount of pollution coming from car exhaust, comparing the results of one to seven days.

time: Several sessions

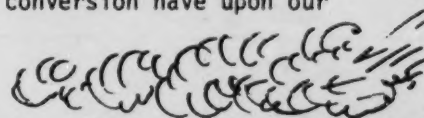
subject matter area: Science, Mathematics

grade: 5-6

implementation:

- Activity: *1. Students are given seven 15cm X 15cm squares of cheesecloth. They are to tape one to the exhaust pipe of their parents' car and leave it on for a day. The number of miles driven each day should be recorded by taking readings from the odometer. They repeat this procedure seven times, adding a day each time (optional). At the end of the experiment they are to compare the cheesecloths, looking for traces of pollution. The teacher should be aware of the many variables involved in this activity as it is written.
2. The experiment could be used on vehicles with added anti-pollution devices. The cheesecloths of these vehicles and vehicles without anti-pollution devices could then be compared.
3. Discussion should follow considering the following points:
- What does this experiment show about energy conversion?
 - What effect does this conversion have upon our environment?

*WARNING: THIS SHOULD BE DONE ONLY
WHEN THE PIPES ARE COLD.



materials:



Enough cheesecloth for each student to have seven 15cm X 15 cm squares.
Tape or wire.



implementation:



Activities:
(cont.)

SUGGESTED CAREER AWARENESS ACTIVITY:

As a citizen have the students write a letter to the State Department of Environmental Quality (D.E.Q.) to find out what anti-pollution measures are being taken in regard to automobiles.



materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, the student will be able to determine the need for anti-pollution devices on automobiles.



Developed by: Patricia Bunger
Olympia School District
Olympia, WA

Revised by: Dan Grimes
EME

title: "The Air Yells, 'Help!'"



impacts



concept: Various energy sources have differing impacts on the environment.

objective: Given the opportunity, the student will trace the development of transportation in the U.S. from its earliest forms to present day and list environmental impacts of modern transportation.

time: Several sessions

subject matter area: Science, Social Studies

grade: 5-6

implementation:

- Activity:
1. Show movie, "The Development of Transportation in the U.S."
 2. Divide class into small groups. Research the development of transportation from early Indians through the present in the U.S.
 3. As a class, make a time-line of important development in U.S. transportation. (Display)
 4. Have students interview parents and grandparents concerning changes in transportation they recall. Consider changes in methods as well as trends.
 5. Have students discuss and list what impact modern forms of transportation have had on the environment. Consider noise and air pollution, space for roads, freeways, energy consumption, etc.
 6. The student will prepare six each 7cm X 10cm cardboards heavily coated with vaseline. Go to the school parking lot. Choose large, small, old and new models of cars.

materials:



Films:

"The Development of Transportation in the U.S.," ENBE, 1958.
"Autos and All That Traffic," COLB, 1969, McGraw-Hill.



implementation:**Activities:**
(cont.)

Include one with a pollution device, if possible. Having obtained the permission of the car owner, start the car's engine and collect exhaust emissions on the cardboard by holding the cards directly behind the exhaust pipe. (Beware! Exhaust fumes are dangerous!) Record the year and the make of the car on the cardboard. Be sure to run each engine for the same length of time. Compare the cardboards and discuss the findings. Record class findings on a chart. Please note the following:

- a. Scientific supply houses may be contacted to obtain kits prepared for emission testing.
- b. Mix and add potting soil and sand. (Obtain sand from a river, if possible, as it will contain more humus material.)

7. Divide class into groups. At a different time each day, each group will inventory traffic at a location near the school, recording its findings on a classroom chart.

Date	Time	No. of Vehicles	Vehicles Emitting Exhaust	Noisy Vehicles	No. of Passengers

8. After all groups have reported, class can tally the last three columns and figure the percentage of vehicles which are polluting air or noise level.

materials:

Implementation:

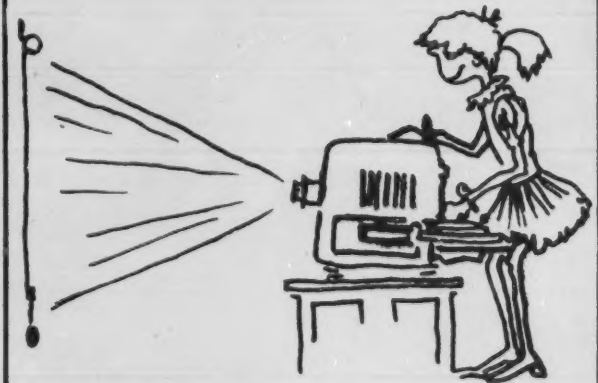
- Activities: (cont.)
9. Show movie, "Autos and All That Traffic."
 10. The student will examine his/her own use of the auto and develop a plan for reduction of use.
 11. The student will describe changes in his/her family's daily activities which would result if they had no auto.
 12. The student will keep a journal of all his/her family's uses of transportation for one week.
 13. The student will examine his/her record for the following considerations. When would it have been practical, considering environmental impacts as well as convenience, to:
 - a. Walk.
 - b. Ride a bike.
 - c. Carpool.
 - d. Use mass transit.
 - e. Other.
 14. The student will formulate a plan of action from his/her examination. He/she will implement this plan for no less than one week.
 15. As a class discuss changes made in transportation use and lifestyle effects. Discuss personal advantages and disadvantages.

Optional Activities:

1. The student will pretend he/she is to write a law restricting the use of personal autos to reduce air, noise and space pollution and gas consumption.
2. The student will find out what people in his community think should be done to control auto pollution. Make findings known to legislators.

materials:**equipment:**

16mm projector



Implementation:



SUGGESTED CAREER AWARENESS ACTIVITY:

Invite a member of the city council to visit the class to be interviewed about his/her job in relation to auto-pollution.



materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, the student will list three (3) things he/she can do to help reduce auto pollution.



Developed by:

Kathy Walker
Crest Drive School
Eugene, OR

Revised by:

Dan Grimes
EME

title: "To Fertilize or Not to Fertilize - That Is The Question"



impacts



concept: Various energy sources have differing impacts on the environment.

objective: Given the opportunity, the student will determine that soil can be modified by adding fertilizer.

time: Several sessions

subject matter area: Science

grade: 4-5

implementation:

Activity:



1. Discuss various types of soil with the students. Include types as sand, loam, clay, etc. Discuss the appearance, texture and water retention capacity of each. Refer to texts: What Is Soil and Ecology.
2. Discuss types of fertilizers (natural or organic fertilizers and artificial, chemical fertilizers). Ask the following questions:
 - a. What effects do fertilizers have upon the environment?
 - b. What are the advantages and disadvantages of organic (natural) fertilizers?
 - c. What are the advantages and disadvantages of chemical fertilizers?
 - d. What if too much fertilizer is used? (If too much nitrogen is released, the plant life will be "burned." Refer to text: Your Lawn: How to Make It and Keep It.)
3. Prepare four containers of each of the following three fish soil types: sand, clay and loam (a total of twelve containers). Determine three different types of fertilizers to be used with the soil samples. The three fertilizers used might be compost or bone meal, a liquid fertilizer and a commercially prepared fertilizer. (Be sure to include both organic and non-organic fertilizers.)

materials:



Pots containing soil (several each of the following: Sandy clay and loam.
Compost should be added to loam.
Cardboard boxes for planting trays.
Plastic sheeting to lining boxes.
Radish seeds
Three types of fertilizer, using both organic and non-organic fertilizers.
Texts:
Carlton, R. Milton
Your Lawn: How to Make It and Keep It
VanNostrand Reinhold Company, 1971
Chapter 4
Schlichting, Harold E.
Ecology, Streck-Vaughn Company,
Austin, Texas
Colby, Carroll
Soil Savers, Coward-McCann, Inc.
New York, NY
Heady, Eleanor B.
The Soil That Feeds Us, Parent
Magazine Press, NY

implementation:

Activities:
(cont.)

Prepare one container of each of the three solid types without fertilizer.

4. Of the three fertilizers chosen by the students in activity 3, use a different fertilizer on each of the three soil samples in each of the three groups.
Example:

<u>Fish</u>	<u>Group I</u> <u>Commercial</u>	<u>Compost</u>	<u>Fertilizer</u>
 Sandy	 Loam	 Clay	
<u>Commercial</u>	<u>Group II</u> <u>Compost</u>	<u>Fish</u>	<u>Fertilizer</u>
 Sandy	 Loam	 Clay	
<u>Compost</u>	<u>Group III</u> <u>Fish</u>	<u>Commercial</u>	<u>Fertilizer</u>
 Sandy	 Loam	 Clay	
	<u>Group IV</u> <u>No Fertilizer</u>		
 Sandy	 Loam	 Clay	

materials:

Syrocki, B.
What Is Soil, Benefic Press
VanDersal, William R.
The Land Renewed, Henry Z. Walck, Inc.

Vertical file materials are useful.

equipment:

Vertical file



Implementation:



Activities: (cont.)

In this way, each of the three soil types is exposed to each of the three types of fertilizer, and each soil type will also be tested for plants produced without the aid of fertilizer.

After adding fertilizer to each of the three groups of soil types, but placing no fertilizer in the fourth group, plant the radish seeds. Discuss plant's need of water and water retention of different soil types. Observe how water runs through sand, but stays in the clay. Refer to text: Soil Savers, page 42.

5. Observe growth of plants. Students will keep a log on observations and activities. (See evaluation section)
6. Present material on conservation such as pictures and charts. Source material can be taken from texts: Soil Savers, The Soil That Feeds Us and What Is Soil.
7. Compare the growth of plants in each of the four groups. Is there an observable difference in plant size such as number of leaves, legginess, etc.? What differences do you notice between fertilized and non-fertilized plants? Between types of fertilizer used? Students should record their observations in their logs. Refer to text: The Land Renewed.

SUGGESTED CAREER AWARENESS ACTIVITY:

Invite a horticulturist to speak to the class about his/her job.

materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, students will keep a log of the following:
Soil types prepared.
Effect of compost.
Water retention of soil.

Students will plant seeds and keep a log on the following:
Which plants came up first.
Which soil retained water.
Which soil needed to be watered more often.

Students will observe the growth of plants in the types of soil used by noting:
Which plants came up first.
Which soil produces healthiest plants.
Which soil produces poorest plants.

Students should be encouraged to discuss the effects of adding compost to the soil.

Developed by: Violet M. Huber
Shirley Barnes
Beaverton School Dist.
Beaverton, OR

Revised by: Dan Grimes
EME

title: "Take A Field Trip"



impacts



concept: Efforts to regulate energy producers and users require energy, economic allocation and political effort.

objective: Given the opportunity, the student will study local zoning laws considering the factors of aesthetics, convenience and energy requirements.

time: 2 - 30 minute sessions

subject matter area: Social Studies

grade: 6

implementation:

- Activity:
1. The teacher should get one or more copies of zoning maps of the local town or city. After studying the maps, the class should plan a field trip (by bus?) that will take them through a variety of zones, e.g., industrial, commercial, agricultural, residential and recreational.
 2. On the planned field trip, students should correlate the buildings and structures they are passing with the zones on the map. They should recognize variations within a given zone, e.g., light and heavy industrial zones.
 3. Upon returning to the classroom from the field trip, the students should discuss what they have seen in terms of:
 - a. Quality of life affected by zoning. "How would you like to live by the bus barn? Above a store? Across from a pool?"
 - b. Economic (energy) reasons for zoning.
 - c. Economic (people's time) reasons for zoning.
 4. A member of the local planning commission should be invited to discuss the criteria for zoning the area visited by the students. Are energy requirements considered in zoning a city? Discuss the occupation of an urban planner - job training and requirements.

materials:



Zoning maps of the local area.



implementation:

Activities:
(cont.)

SUGGESTED CAREER AWARENESS ACTIVITY:

Have small groups plan a community for 5,000-10,000 residents, showing how they would zone it and giving reasons for their choices.

For a more advanced (older?) class, have them plan a community for 5,000-10,000 residents

- on a lake
- with scattered small lakes and a river
- in a hilly or mountainside area
- at the edge of a swamp

As a class, select one of the student's imaginative solutions and create the job responsibilities needed to operate the invention.



GREEN RIVER, WYOMING

materials:SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity to take a field trip, the student will be able to recognize various land zoning areas and why they are zoned that way.

Developed by: Lois Helton
Beaverton School Dist.
Beaverton, OR

Revised by: Dan Grimes
EME

title: "The Kool-Aid Stand"



impacts



concept: Conflicts over ecologically sound practices and aesthetic judgments will involve trade-offs if they are to be resolved.

objective: Given the opportunity, the student will prepare an Environmental Impact Statement for the purpose of starting a hypothetical business (Kool-Aid stand business).

time: 4 - 30 minute sessions

subject matter area: Social Studies, Science
Art, Language Arts, Mathematics

grade: 4-5

implementation:

- Activity:
1. This decision-making activity involves the students in planning a business venture in order to earn spending money. (e.g. Kool-Aid stand business, raising animals, kennel service when friends are out of town, etc.) This business should be one the students can relate to as well as one that has an effect on the neighborhood environment, such as noise pollution, water pollution, air pollution, land pollution, emotional stress of parents and neighbors, etc. We found the Kool-Aid stand business an exciting and controversial one to have in regards to environmental impact.
 2. The Environmental Impact Statement is a plan or statement the students will prepare in order to convince their parents and neighbors that their business will not have a negative impact on the neighborhood. The students will present ideas on how to solve the problems their business will bring about, such as noise, litter, traffic control, lawn and shrub damage, blocking sidewalks and many other problems parents and neighbors would be concerned about.

materials:



Film - "Treasure Hunt," 20 minutes, color, 1975 - Bread and Butterflies Film Series. Distributor (Milliken) Published by National Instructional TV



implementation:

- Activities:** 3. In selecting the Kool-Aid stand business, your students need to be concerned with the Environmental Impact of the following:
- Plant Site - Where on the neighborhood street should a Kool-Aid stand be placed; i.e., parent's yard, corner, etc.? (Think of the environmental damage.)
 - Construction - Of what material will the stand be made? (Consider visual pollution.)
 - Purchasing Supplies - What will you use in dispensing the Kool-Aid and what other things must you buy to make the Kool-Aid? Could the supplies be harmful to the environment? (litter, etc.)
 - Manufacturing - Will the waste be harmful? How will you solve the problem? Where and how will you obtain water?
 - Advertising - Litter? Visual pollution?
 - Traffic Control - Cars, bicycles, people, noise, fumes, etc.
 - Plant Clean-Up - What will you do with the daily waste? Recycling cups? Soap suds, etc?
 - Consumer Waste - Litter? Recycling? Cleaning up after them? Who is responsible - you or the customer?
4. Develop a method for the creation of an Environmental Impact Statement that will hopefully convince parents and neighbors that the Kool-Aid stand business will not harm the neighborhood. NOTE: Before doing this the teacher should send a note home to the parents explaining what the purpose of the lesson is and ask them to critique their child's proposal with concern. The actual Kool-Aid stand business does not have to be carried out.

materials:

implementation:

- Activities: (cont.)**
5. In the first two days of this project the class should discuss the notion of hypothetically starting a Kool-Aid stand to make spending money. Inform the class that in starting a business like this they must first convince their parents and neighbors and get their approval for the project.
 6. A list of the following should be made on butcher paper on the chalkboard:

Plant site	
Constructions	
Purchasing	Leave room between items for
Manufacturing	students' suggestions and ideas.
Advertising	
Traffic control	
Plant clean-up	For plant site, use a typical
Consumer waste	neighborhood street in Anytown,
	U.S.A.
 7. Ask the students to make decisions about each area above. Where will we build the Kool-Aid stand? Why? What harm will the location have on the environment, if any? What will we use to build the stand? Will it be visually polluting?
 8. When the class completes the statements that they think will convince their parents concerning each area of business, the teacher should list these on a ditto so each student will get a copy to take home for parental approval.
 9. In the final two days, have the students share the results with the class concerning whether their parents were convinced or not and why. During class discussion revise the Environmental Impact Statement, if needed, and resubmit it to the parents for approval again. Continue class discussion until approval is granted.

SUGGESTED CAREER AWARENESS ACTIVITY: As a class, have the students start a class business of their own and sell the product to the student body.

materials:SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, the student will list at least four (4) things to consider when preparing and Environmental Impact Statement.



Developed by: Dan Grimes
EME

title: "Waste Paper Study"



impacts



concept: Conflicts over ecologically sound practices and aesthetic judgments will involve trade-offs if they are to be resolved.

objective: Given the opportunity, the students will collect the trash from the classroom each day for a period of four weeks in a garbage sack, weighing the bag each afternoon.

time: Less than 10
minute sessions

subject matter area: Mathematics

grade: 4-5

implementation:

- Activity:
1. The teacher will announce to the students that they will hold an experiment for two weeks, weighing the trash each day before the last bell.
 2. The class will make a large graph to mark the weight each night.
 3. After the first week, the class will look at the chart and discuss why some days had more trash than others. (Art, etc.)
 4. The students will follow activities 1, 2 and 3 for one more week.
 5. The teacher will announce "Cut the Trash in Half" week. She will ask students to use both sides of their papers and may suggest other conservation actions.
 6. The trash will be collected each afternoon, weighed and charted.

materials:

Trash bags (several, they break easily)
Poster board
Magic markers
Ruler



implementation:



Activities:
(cont.)



7. The students must be told not to "hold back," but to throw away what they need to.
8. At the end of two weeks, the students will compare the markings on the graph. "How different were the first two weeks' weight compared to the last two?"
9. The teacher and the class will discuss - "Was the experiment worthwhile? What did we learn?"
10. The students, directed by the teacher, will decide how to follow up the project.
11. After several weeks, the teacher might want to "pop" a trash weighing on the students to see if they slipped back to wasteful uses of paper, etc., or if they were taking conservation seriously.

SUGGESTED CAREER AWARENESS ACTIVITY:

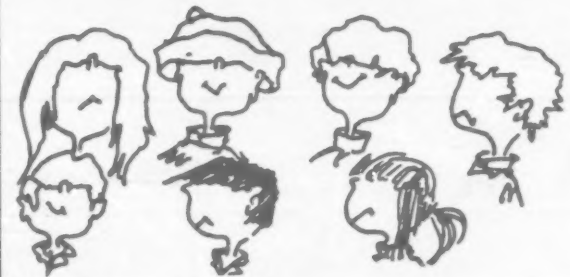
Invite a trash collector to school to tell about his/her job and about what people could do to help reduce waste.

materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity to conserve, the student will be able to reduce the amount of classroom waste.



Developed by: Sara Campbell
Cheyenne, WY

Revised by: Dan Grimes
EME

title: "You and Your Environment"



impacts



concept: Conflicts over ecologically sound practices and aesthetic judgments will involve trade-offs if they are to be resolved.

objective: Given the opportunity, the student will determine methods already being used in school and community to clean up the environment and will become aware of other possible environmental activities which could be undertaken by school or community.

time: Several sessions

subject matter area: Mathematics, Language Arts
Science, Social Studies

grade: 5

implementation:

- Activity:
1. Show and discuss the film "Environment." It presents both sides of the environmental question.
 2. Have students discuss what things are already being done for the environment in their school and community. If they decide they would like more information in this area, two survey questionnaires may be prepared; one for school personnel and one for the community. (See attached copies.)
 3. Decide which students are to interview whom and set time aside for them to interview the school personnel, including principal, teachers, custodians, secretaries and cooks. The students set up their own schedule for interviewing community members.
 4. Interviews should be performed throughout the week. In class discuss things that the students, as a class, could do. One group suggested the following:
 - a. Taking time to clean up our school grounds once a week.
 - b. Possibly working in groups to clean up their own neighborhood areas.

materials:



Film - "Environment," BFA, 1971.
Make up survey questionnaires.
Equipment for gardening - hoe, rakes, seeds, stakes, ropes, etc.
Material for compost pile and good location for it.

equipment:

16mm projector



implementation:**Activities:**
(cont.)

- c. Grow their own garden and fertilize it with compost from a compost pile made of school lunch waste and grass clippings, etc., from school yard-work. For additional information on making compost gardening, see any reliable garden manual or call a county agricultural agent.
 - d. Initiate and support a monthly community recycling drive.
5. Students divide into pairs to decide what to plant in their garden plot. They then plan how and when to do their garden work, i.e., how to stake their plot, what tools are needed, seeds needed, etc.
 6. Students make decisions on how to organize to clean up the school grounds.
 7. Students discuss the results of the surveys for the school and the community.
 8. Students evaluate and discuss results of all activities in this lesson.
 9. These projects (gardening and school ground clean-up, specifically) continue throughout the rest of the school year.

SUGGESTED CAREER AWARENESS ACTIVITY:

While students are interviewing school personnel, they should realize that cleaning up the environment is part of the worker's job responsibility.

materials:**SUGGESTED ASSESSMENT PROCEDURE:**

Assess activity 1 through oral response.

Assess activities 2,3, part of 4 and 7 through the recording and discussion of the survey results. The students enjoy surveying school personnel and the community; this activity not only suggests projects such as cleaning up school grounds and/or using school lunch wastes but also teaches how to conduct an interview.

Assess activity 4 through action and involvement of the students; i.e., the actual planning and planting of a garden and use of compost. Children love being active and involved. Children feel pride and accomplishment in seeing their school grounds cleaned up, knowing they were mainly responsible.

Developed by: Shirley Barnes
Beaverton School District
Beaverton, OR

Revised by: Dan Grimes
EME

SAMPLE SURVEY INSTRUMENT
FOR SCHOOL PERSONNEL

We are fifth grade students from Mrs. Barnes' class at West Tualatin View and we are studying about the environment.

We would like to ask you some questions about things that can be done to help our environment.

Thank you for your cooperation.

Name _____

Address _____

1. What is now being done at West Tualatin View to help clean up the environment?
2. What new things can be done at West Tualatin View to help clean up the environment?
3. How would you feel about having a compost pile located somewhere on the school grounds?

SAMPLE SURVEY INSTRUMENT
HOME

We are fifth grade students from Mrs. Barnes' class at West Tualatin View and we are studying about the environment.

We would like to ask you a couple of questions about things that can be done to help our environment.

Thank you for your cooperation.

Name _____

Address _____

1. What is now being done in our community to help clean up the environment?

2. What other things, which are not being done now, could be done to help clean up the environment?

title: "Meter Reading"



impacts



concept: There are many ways to conserve energy.

objective: Given the opportunity, the student will list ways by which energy may be conserved at home, school, and in the broader community.

time: 4 - 30 minute sessions

subject matter area: Mathematics

grade: 6

implementation:

- Activity:
1. 30 minutes: Have four students using each meter. The dials are read right to left; the right hand dial is the same as ones, second from right is tens, third from the right is hundreds and fourth from the right is thousands. Note that the dials are numbered in alternate directions, clockwise and counterclockwise. If the needle on the dial is between numbers, record the smaller number. When reading a dial with a pointer on a number, check with the one on its right. If it has not reached or passed zero read the next lower number. Have each student team move from meter to meter and write down their reading of all eight meters. These readings can then be put on the board and checked for accuracy.
 2. 30 minutes: Discuss what a kilowatt hour is. Look under "meters" in Comptons Encyclopedia or use other texts. Teach how the previous month's reading is subtracted from the present month's reading to find the number of kilowatts used in a month. This is good subtraction practice for math.

materials:



8 actual electric meters or cardboard substitutes.

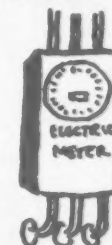
Films:

"The Columbia River," COR, 1966

"Columbia River - Economic Lifeline," BLY, 1967

equipment:

16mm projector



Implementation:

- Activities: 3. 10 minutes each day for 7 days: As a homework assignment locate your electric meter at home and read it accurately each day. Do this for seven consecutive days, recording the readings each day and figuring how many kilowatts were used in each 24-hour period. (Caution: Meter must be read at same time each day.)
- (cont.)
4. 30-45 minute discussion: What days were the largest amount of electricity used? Find out why. What appliances use the most electric current:
- Heating home with electricity.
 - Heating water.
 - Cooking with electricity.
 - Air conditioning home in hot weather.
 - Ironing.
 - Electric lights. Add up the wattage of all the light bulbs in your home and see what the total watts are. Don't forget attics, basements and garages.
5. 30-60 minutes (depending on class size): Have students check with their parents to learn what your electric bill was for the last three months. What would be the easiest way to reduce it? Make a list of at least ten ways to reduce use of electricity. Try to list where you could save the most first and put them in descending order.
6. A field trip to Bonneville Dam or Trojan Nuclear Plant, or an electrical-generating plant in your area, could add much to this learning activity. (The address for the Trojan Nuclear Plant in Washington is: Trojan Visitors Information Center, Route 2, Box 120, Rainier, Washington 97048.)

materials:

implementation:



Activities:
(cont.)

SUGGESTED CAREER AWARENESS ACTIVITY:

Have the students role play being an electric meter reader for the community. Give them a set of meter readings along with the current price for each K.W.H. used. Have the students figure out how much the bill will be for the hypothetical customer.

WHAT OTHER WAY IS THERE
TO MAKE ELECTRICITY?



materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity to learn how to determine the amount of electricity used in the home, the student will be able to list ways that will help reduce the use of electricity.

Developed by: Albert Gruen
Beaverton School Dist.
Beaverton, OR

Revised by: Dan Grimes
EME

title: "A Trip To A Factory"



impacts



concept: Industrial societies have a greater impact on the environment than do agrarian societies.

objective: Given the opportunity, the student will be exposed to the workings of a large company and its concerns and obligations for cleanliness and environmental impact.

time: Varied (field trip) **subject matter area:** Social Studies

grade: 5

implementation:

- Activity:
1. There are a few things the teacher will have to do that are not listed in the procedures. Each school policy is different. Many teachers will need principal OK, permission slips, transportation, etc. The teacher will probably want to make arrangements for the speaker and tour personally.
 2. The teacher and students will discuss the importance of keeping their schools and homes neat and clean.
 3. The teacher and students will discuss why it also is important for a factory or large business to be kept neat and clean.
 4. What occupations are involved in keeping factories and businesses neat and clean?
 5. The teacher will announce to the class that a speaker from a local soft drink bottling company is coming to speak to the class about the items they have been discussing. (Other local industry representatives will do also.)

materials:

Thank You Poster: Poster board and magic markers



implementation:

- Activities: (cont.)
6. After the speaker's presentation and a question and answer period, the speaker will invite the students to visit the plant (teacher has already made arrangements).
 7. After the speaker leaves, the students can discuss possible questions they might want answered on the field trip.
 8. On the set day, the class will take a tour of the bottling company or other selected company.
 9. Back in class, the teacher and children can talk about what they heard and saw.
 10. The class will design and make a "Thank You Poster" to send to the bottling company (a slight change from letters).
 11. The class will rediscuss what they can do to keep their environment clean (e.g. town, school, home).

SUGGESTED CAREER AWARENESS ACTIVITY:

Have a discussion about the following question: "Who has the responsibility of keeping the factory clean?"

materials:SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, the student will be able to list ways in which an industrial plant is kept clean.



Developed by: Sara Campbell
Cheyenne, WY

Revised by: Dan Grimes
EME

title: "Trains or Trucks"



impacts



concept: Industrial societies have a greater impact on the environment than do agrarian societies.

objective: Given the opportunity, the student will assess the relative aesthetic effects of railroad vs. freeway transportation.

time: Varied

subject matter area: Mathematics, Social Studies

grade: 4-5

implementation:

- Activity:
1. First phase: Either through a bus field trip or by individuals who can collect data for the class, make a survey of land-use for transportation in your area as follows: Inspect a kilometer stretch of railroad track nearest you, looking to see how much space the railroad occupies with ties, tracks, and land reserved on either side (right of way). Then, as a group, examine a kilometer of superhighway or freeway, the kind carrying trucks, busses, and cars from city to city, to see how wide an area is used for a four or six lane freeway.
 2. Compare the relative amount of land used for railroads and freeways, kilometer by kilometer.
 3. Additionally, some students might look up the amount of energy (fuel) needed to transport a ton of goods by railroad and by truck transport.
 4. The class should discuss whether they would choose to have their community served by truck or have their community served by train transport, considering energy used and land use. Which is more attractive in a community?



materials: None.



equipment:

Bus for a field trip.

**TRUCK
VS
TRAIN TRANSPORT**

implementation:



Activities:
(cont.)

SUGGESTED CAREER AWARENESS ACTIVITY:

Invite a local railroad employee to school to talk about his/her job and about train transportation.

materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, the student will be able to determine which is more attractive and/or practical, between train and freeway transportation.

Developed by: Lois Helton
Beaverton School District
Beaverton, OR

Revised by: Dan Grimes
EME

title: "The Last Frontier"



impacts



concept: -Industrial societies have a greater impact on the environment than do agrarian societies.
-New technologies and careers have resulted from energy production and use.

objective: Given the opportunity, the student will be able to list harmful and beneficial effects upon a frontier town resulting from the introduction of a railroad.

time: Several sessions

subject matter area: Social Studies, Art, Mathematics

grade: 4-5

implementation:

- Activity:
1. Students recreate a frontier town with wooden houses, fences, fort and livestock.
 2. Students discuss the effects on the town if a railroad were to be built. Include all aspects of environmental change.
 3. Speakers come to class and discuss with students energy requirements needed to operate a steam locomotive. A model steam engine may be operated to demonstrate these requirements. Compile a list of needed materials.
Speakers should also discuss various occupations available and training necessary for jobs related to the railroad.
 4. Filmstrip, "Settling the Last Frontier," Eyegate.
 5. Class should discuss in small groups needed changes to town if a railroad were to be built. Include physical changes, and environmental impact on the community. For example, how would the railroad affect land use, population, and jobs?

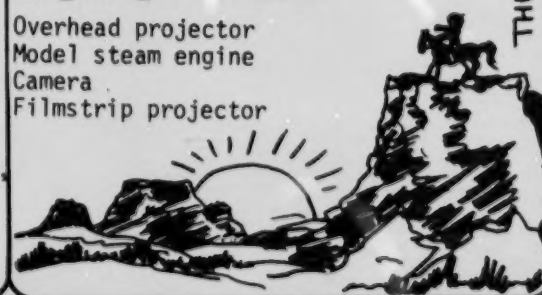
materials:

Filmstrip
Straw for roofs of houses
Tag board
Plastic livestock animals
Paints
Pine cones for trees
Tongue depressors - fence
Gravel
Train
Straws - tracks



equipment:

Overhead projector
Model steam engine
Camera
Filmstrip projector



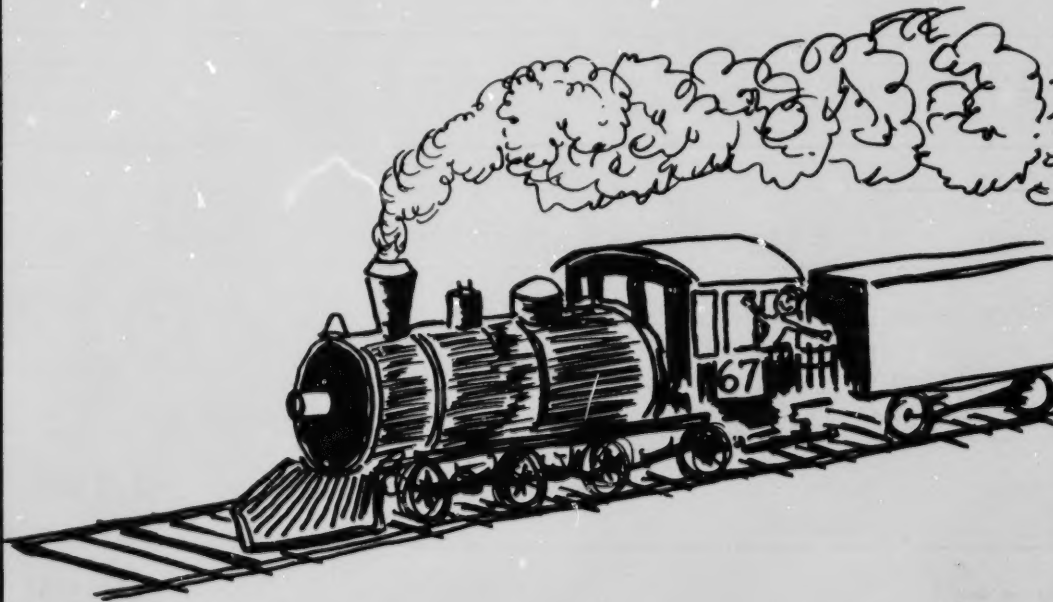
implementation:



- Activities: 6. Discuss how to implement those changes in our particular town.
(cont.)
7. Reconstruct town to facilitate railroad.

SUGGESTED CAREER AWARENESS ACTIVITY:

Have the students role play occupations as the frontier is being constructed and assimilated to real life. When the railroad is introduced, make note of the number of jobs unaffected, modified or eliminated.



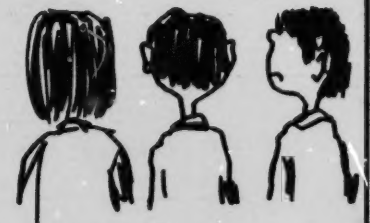
materials:



SUGGESTED ASSESSMENT PROCEDURE:

Students make a list of the environmental effects of a railroad upon town.

Students list individually harmful and beneficial effects of railroad upon town. Students will be able to choose one of the harmful effects and alter it to become beneficial.



Developed by:

Doug Smith
Shari Konishi
Beaverton, School Dist.
Beaverton, OR

Revised by:

Dan Grimes, EME

title: "Bagasse"



impacts



concept: Some uses of energy are more threatening to ecosystems than are others.

objective: Given the opportunity, the student will be able to explain how bagasse (sugar cane waste) is being used as a clean energy source rather than a pollutant, and to list other industries which are beginning to change wastes into useful energy sources.

time: 5 - 30 minute sessions

subject matter area: Art, Science, Social Studies

grade: 5-6

implementation:

- Activity:
1. Review the enclosed article and have the class discuss and make a study of how industry has converted a pollutant waste into a clean, useful energy source and in the process preserved the sugar cane industry in Pepeekeo, Hawaii.
 2. Make a flow-process chart (an example of this flow-process activity is enclosed) showing how the bagasse (sugar cane waste) was originally wasted and dumped into the ocean. Compare this to the way it is now used as a clean energy source of electricity for the sugar cane plant and for the Hilo Electric Company.
 3. Make a study, accompanied by a flow-process chart, of other industries making use of wastes. Examples of industries converting wastes to sources of energy or other good uses:
 - a. The American Potato Company is using effluent as a fertilizer.
 - b. The Georgia-Pacific Corporation has a plant in Toledo, Oregon, which is burning garbage to produce fuel. (For further information regarding Georgia-Pacific Corporation, contact Mr. Joseph Bennett, 900 S. W. Fifth, Portland, OR)

materials:

Materials are included.



implementation:



Activities:
(cont.)

- c. The logging industry can use slash in the forest as a fertilizer. (European method)
- d. Have students ask their parents how wastes could be made useful in their particular occupation.

SUGGESTED CAREER AWARENESS ACTIVITY:

As a follow-up, have the students work in groups of three or four to design other waste-utilization projects. Examples might be:

- a. How could water made dirty by industry be made useful? (Exp: In Moses Lake, Washington, effluent is being used as plant fertilizer.)
- b. How could old rubber tires be used?
- c. How could garbage be used as an energy source?
- d. How could sewage be made useful?

Various newspaper and magazine articles on waste conversion could be used for a bulletin board as well as an information source for the suggested activities in this lesson plan unit.

materials:



SUGGESTED ASSESSMENT PROCEDURE:

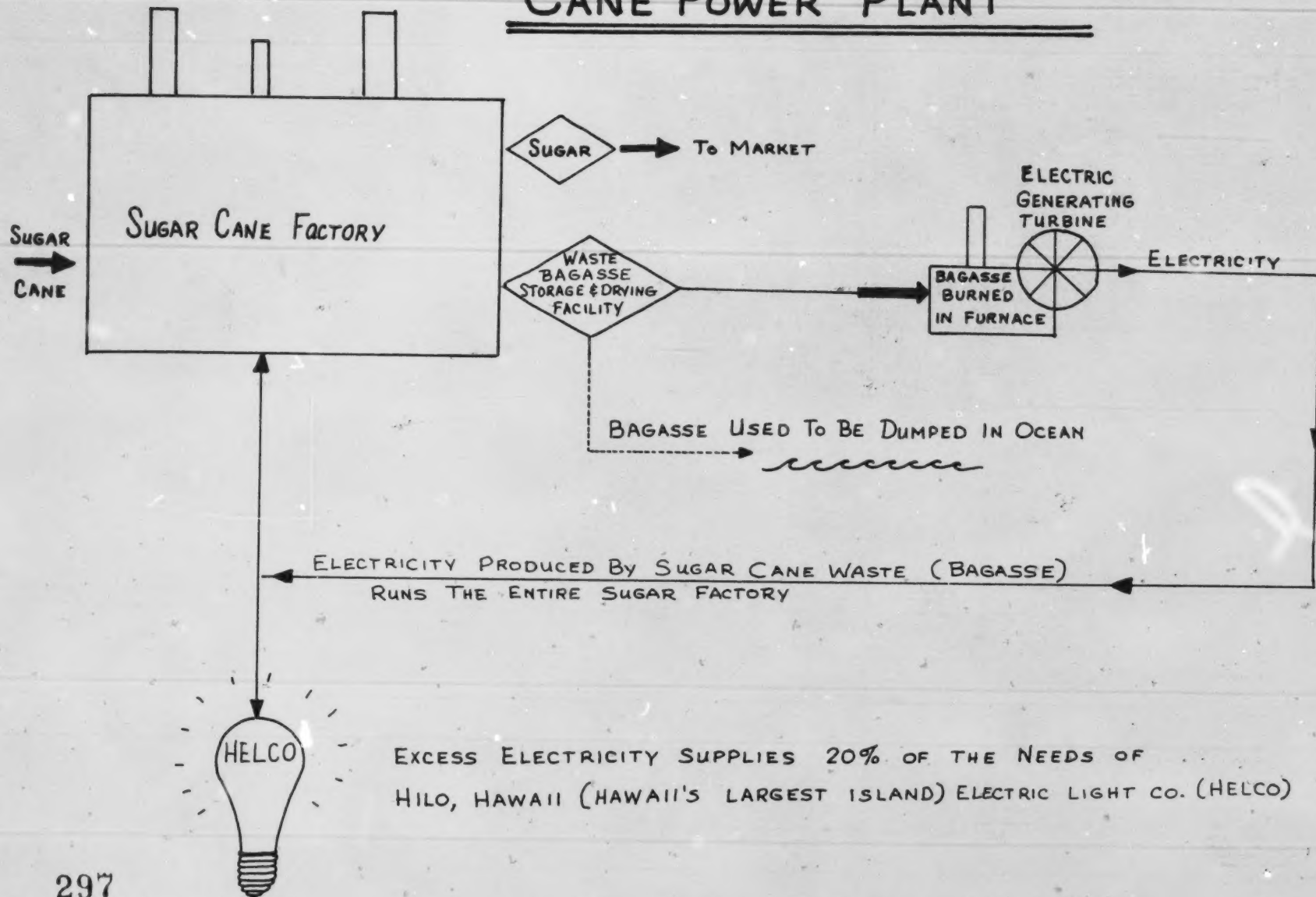
The students will produce flow-process charts explaining how various industries are converting wastes into useful products.

The students will produce a design of one new waste-utilization project.

Developed by: Shirley Barnes
Beaverton School Dist.
Beaverton, OR

Revised by: Dan Grimes
EME

CANE POWER PLANT



Big Isle Energy Source

CANE POWER PLANT

By Hugh Clark

Advertiser Big Island Bureau

Pepeekeo, Hawaii--C. Brewer is about to fire up the Island's largest non-fossil-fuel electric-generating plant, designed to operate on cane trash which used to be dumped in the sea.

The \$9 million Pepeekeo power plant--which will produce up to 24 kilowatts an hour--is being completed as part of a larger \$27 million expansion, modernization and pollution-abatement program by the Brewer firm.

The plant will be dedicated tomorrow as part of the \$19 million new sugar-factory operation by Hilo Coast Processing Co., a cooperative made up of four former Brewer sugar companies and 400 independent sugarcane planters.

Acting Gov. George Ariyoshi and industry, union and community leaders will speak at the 10:30 a.m. program for 150 invited guests at the factory site. Public tours will begin at 3 p.m.

The power plant will produce enough electricity to run the entire Pepeekeo factory and provide 20 percent of the Big Island's commercial needs for Hilo Electric Light Co. (HELCO).

HELCO is buying the excess energy generated from the 80-foot-high furnace, which will consume up to 1,500 tons of bagasse a day.

The bagasse-cane from which sugar has been extracted--is stored in an adjoining holding facility. An automatic bagasse shovel will feed the furnace. It is operated by men located in the power plant several dozen yards away in a control room using isolated television monitors.

The entire power plant, the most modern in Hawaii, will require just three men per shift for operations. They come from a pool of 14 men whom Brewer trained.

The plant is scheduled to begin generating power on Monday for energy-starved HELCO, which has been hard-pressed to keep up with the Big Island's demands.

The plant is scheduled to use only bagasse as a power source. Bagasse had been dumped into the nearby ocean as waste until now.

In the early stages, however, the plant is to be supplemented by fuel oil to provide for HELCO's needs.

The natural-energy plant is the featured attraction in the over-all \$27 million investment which Hilo Coast Processing is making here.

The former Ewa Sugar Co. mill has been brought here from Oahu and completely rebuilt to provide a 3,600-ton-per-day sugar mill that becomes the largest on the Big Island.

Cane Power Plant
(continued)

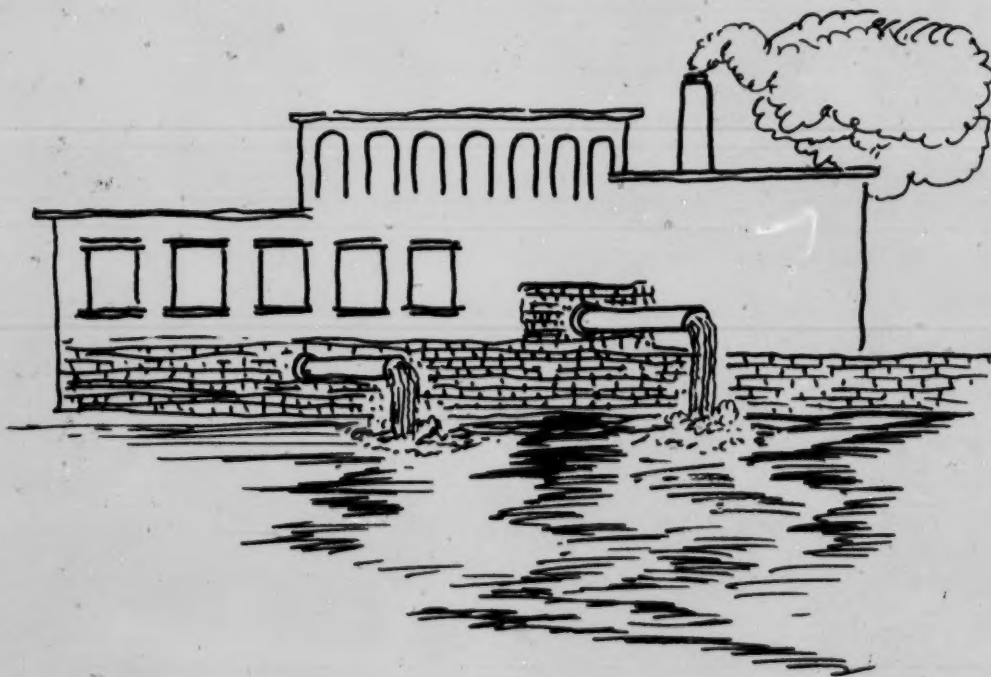
It will be responsible for replacing three existing factories being operated by Brewer--including Hakalau and Wainaku, which are being shut down at the end of the year. The former Pepeekeo mill is being converted to a cleaning and bagasse-de-watering unit to prepare the fuel for the furnace at the power plant.

A related \$2.6 million project at the Papaikou mill to meet Federal pollution standards is involved in the over-all Hilo Coast updating program.

Completion of the project here is the result of seven years of planning for sugar's future on the Hilo coast. Brewer in 1967 considered either a merged and expanded-factory program or going out of business to meet the twin challenges of quitting pollution practices and rehabilitating factories built before 1910.

Although the completion of the equipment here will stop the practice of dumping cane wastes into the ocean, Hilo Coast has two more years to develop water-treatment facilities to halt the outflow of dirty water containing rocks and mud.

By 1976, a cleansing program was expected to remove 97 percent of all soil pollutants. The recovered material will be used for road building and field repair as the preliminary steps in a long-range land-reclamation program.



Examples of recent articles on waste conversion.

Sand Dunes Transformed EFFLUENT NOURISHES WILD PLANTS

Moses Lake, Wash. (AP)--Since the American Potato Co. started sprinkling sand dunes with its waste water three years ago, the once-barren land has become lush with Russian thistle, lamsquarter, surfpea and other wild plants.

And where once windblown sand was the only thing moving, rabbits, pheasants, owls and coyotes had come to live. More recently, cattle and sheep have been introduced to feed off the land and keep the "jungle" down.

The U.S. Forest Service, which has monitored the project, is interested in possible use of such practices on national forest land. Forest Service officials say it could lead to fertilizing forests with partially treated sewage.

One million gallons of effluent -- mostly used water from cleaning potatoes -- is sprayed over the 200-acre site each day through a four-mile long sprinkler system.

"It's the lifeline of the plant," says Bill Stroho, potato plant manager. "We're more interested in waste disposal than in growing things, but it turns out that the waste is providing some extra income."

Attempts have been made to seed the area but thus far only wild plants have grown.

Cattle grazing on the land have gained two pounds per day, and usually can graze at about one animal per acre.

"They learn to like it real quick," one official said. "It's strange to them at first, but they like it all right."

And Dr. Glen Klock, a Forest Service soil scientist, says the growth stabilizes the sand dunes and keeps them from inundating neighboring farm lands.

"So far there have been no adverse effects whatsoever," said Dr. Art Tiedemann, project leader of the Forest Service Hydrology Lab in Wenatchee.

Although the effluent from American Potato Co. is relatively harmless, the test is a step in the process that could lead to the dumping of treated sewage over wide areas of range and wildlife areas.

"This flume water is very similar to sewage," Dr. Tidemann said. "About the only thing we don't have are the heavy metals and bugs, the bacteria in sewage."

The project is not irreversible.

"All you'd have to do would be to turn off the water and the land would quickly revert back to sand dunes," said Dr. Klock.

The results of the test will be presented at a Society of Range Management meeting in Mexico City next February.

PLANT EFFLUENT FOUND USEFUL

Murtaugh, Idaho (AP)--A new plant in this south central Idaho farming area is accomplishing two goals at the same time.

It is taking a byproduct nobody wanted and turning it into a product manufacturers are having an increasingly difficult time making.

The A. E. Staley Manufacturing Co., Decatur, Ill., has opened a new plant which takes effluent from potato processing plants and makes industrial grade starch out of it.

Waste which otherwise is only a nuisance is hauled by tank trucks from spud processing plants to drying equipment at Murtaugh. It comes as a slurry from nearby plants and others at Caldwell and American Falls, Idaho, and Ontario, Oregon.



title: "Starting A Business"



impacts



concept: The use or non-use of any energy source requires environmental trade-offs.

objective: Given the opportunity to outline a hypothetical business, the students will determine that the decisions they make about environmental trade-offs are based on internalized values.

time: 4 - 30 minute sessions

subject matter area: Social Studies, Language Arts, Health, Art

grade: 6

implementation:

Session I:

1. Introduction -- discuss with your students the jobs they have had to make money to spend and/or save. Ask those students how they went about getting and starting their jobs.
2. Tell the class that they are going to develop and start a hypothetical business in small groups of 3, 4 or 5. These businesses should be one that the students could really do for part time work during the school year and/or summer.
3. Have the students break themselves into several groups. Tell them that they must use the following guidelines in setting up their business:
 - A. As a group, decide what the business will be called:

(title)

- B. List the things you will need to get the business started (materials; resources of any sort).

materials:



Butcher paper
Felt tip markers

Film:

"Treasure Hunt", Bread and Butterflies Film Series, A.I.T. (American Instructional Television)



implementation:

Sessions
(cont.)

- C. List the problems, situations, circumstances, and/or considerations that might arise as a result of your business venture.
- D. List a solution for every item in C. above.
- E. Assign responsibility to the team members for the tasks that need to be performed in the business.
- F. Have the group tentatively agree on how they would solve any working relationship problems that might occur.

It is suggested that the students fill out a framework such as the example below:

Title: _____	
Things we need	
Problems - Situations, etc.	Solutions to the Problems
1	1
2	2
3	3
4	4
5	5
6	6
7	

materials:

implementation:



SESSION II:

4. Have the students display and/or share their hypothetical business plans with the class.
5. Discussion:
 - A. Ask the students why they made various decisions and choices.
 - B. Discuss the importance of the following traits and how they relate to the activity (Starting A Business):
 - (1) Honesty
 - (2) Dependable
 - (3) Cooperation
 - (4) Responsibility
 - (5) Promptness
 - (6) Others

Optional: Film - "Treasure Hunt" from Bread & Butterflies film series (use as an introduction).

SESSION III:

Follow-up Activity: Tell the students that before they could start a business in operation, they would have to get permission from the right people (i.e. parents, teachers, neighbors, etc.) by writing a position paper that describes the business and the effects it would have on people, the environment, etc. This paper can be called a Business License Request and/or an Environmental Impact Statement. The paper has to convince the right people before the business can begin. (See sample form.) Keep returning the form back to the students until it is satisfactory.

materials:



Implementation:



SESSION III: (cont.)

(Teacher and/or parents will negotiate with the students.)

*Determine how values enter into the decision making process.

SUGGESTED CAREER AWARENESS ACTIVITY:

Invite a person from your local utility to share an environmental impact statement the company has prepared.

Have the students decide on job titles for the various positions in their business.

Adaptations - each individual student can develop his/her idea of starting a business rather than in a group situation.

Primary students can do this activity as a class with the teacher leading them through a discussion and writing their responses on the board.



materials:



SUGGESTED ASSESSMENT PROCEDURE:

- Given the opportunity, the student will be able to outline a hypothetical business, file an environmental impact statement, and have it approved.
- Given the opportunity, the student will determine how his/her and other values inter-play in the decision making process.



Developed by: Dan Grimes
EME



activities



Student Handout

Application Form:

BUSINESS LICENSE REQUEST FORM

ENVIRONMENTAL IMPACT STATEMENT

1. Names of person(s) (1) _____ (2) _____
Requesting License: Last First MI Last First MI
(3) _____ (4) _____
Last First MI Last First MI
2. Address(es) of person(s) filing:
(1) _____
Street City State Zip Code
(2) _____
(3) _____
(4) _____
3. Title of Business: _____
4. Location of Business: _____

5. Purpose of Business: _____

6. A. How will the business affect the environment? _____

B. How will you solve any environmental problems? _____

7. A. How will the business affect citizens? _____

B. How will you solve problems with the citizens? _____

FOR OFFICIAL USE ONLY
(Permission Section)

1. Person reviewing application: _____
2. Yes, I approve and am convinced: _____
3. No, I do not approve. You must convince me that the following concerns will be taken care of before I will grant permission: _____

title: "Simulated Community"



impacts



concept: The use or non-use of energy source requires environmental trade-offs.

objective: Given the opportunity, the student will be able to construct a simulated mini-community that creates an ever growing need for energy conservation.

time: Several days,
on-going.

subject matter area: Mathematics, Social Studies
Art, Science

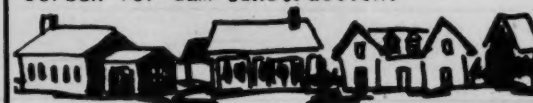
grade: 4-6

implementation:

- Activity: 1. This activity will stress conservation of all our natural resources. The students will make the entire project from easily obtainable materials.
- Pictures and blueprints are included to aid in construction. Simple cardboard houses and more complex wooden structures are explained in detail.
 - The power furnished by the dam is in the form of two 1-1/2 volt batteries buried at the side of dam site. The wiring is buried and brought to surface at housing project.
 - The houses being constructed are connected to the batteries one at a time. Each house has a miniature socket and bulb inside; and, as each new house is added, the power needs to go up. Soon another battery has to be added and another until there is no room for more. No more houses can be added and the problem is quite obvious to each child.

materials:

Plywood for dirt box construction.
1/8" balsa strips for house construction
Railroad or poster board for house construction.
Splints for house siding and roof.
Mirrors for lake and streams.
Water pump for pumping back into lake if making actual lake.
Match box cars, trucks, tractors, etc.
Thread for wires.
Colored lichen for tree construction.
Brown pipe cleaners for tree construction.
Miscellaneous widths and thicknesses of balsa for bridge, docks, dam, etc.
Toothpicks for power poles and fencing.
1-1/2 volt batteries.
Plaster of paris.
Water proofer for plaster of paris.
Screen for dam construction.



implementation:



SUGGESTED CAREER AWARENESS ACTIVITY:

- Role play various occupations needed to construct the mini-community. Students can form sub-contracting construction groups to build certain phases of the community.
- Invite local people to the class that would directly relate to the simulated community to share real life experiences.



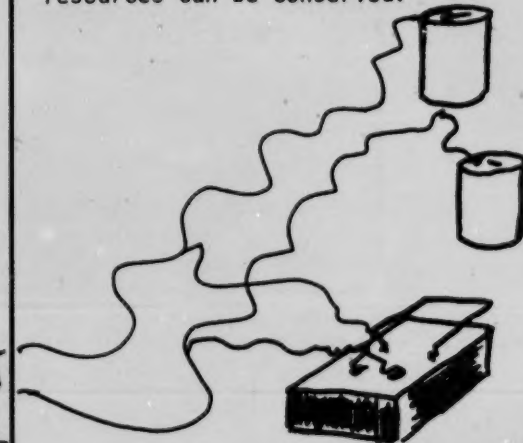
materials:



NOTE: This list contains a few essentials but the list grows with your desires.

SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity to construct a mini-community, the student will be able to list ways the simulated natural resources can be conserved.



Developed by: Harold Mobley
Medford School District
Medford, OR

Revised by: Dan Grimes
EME

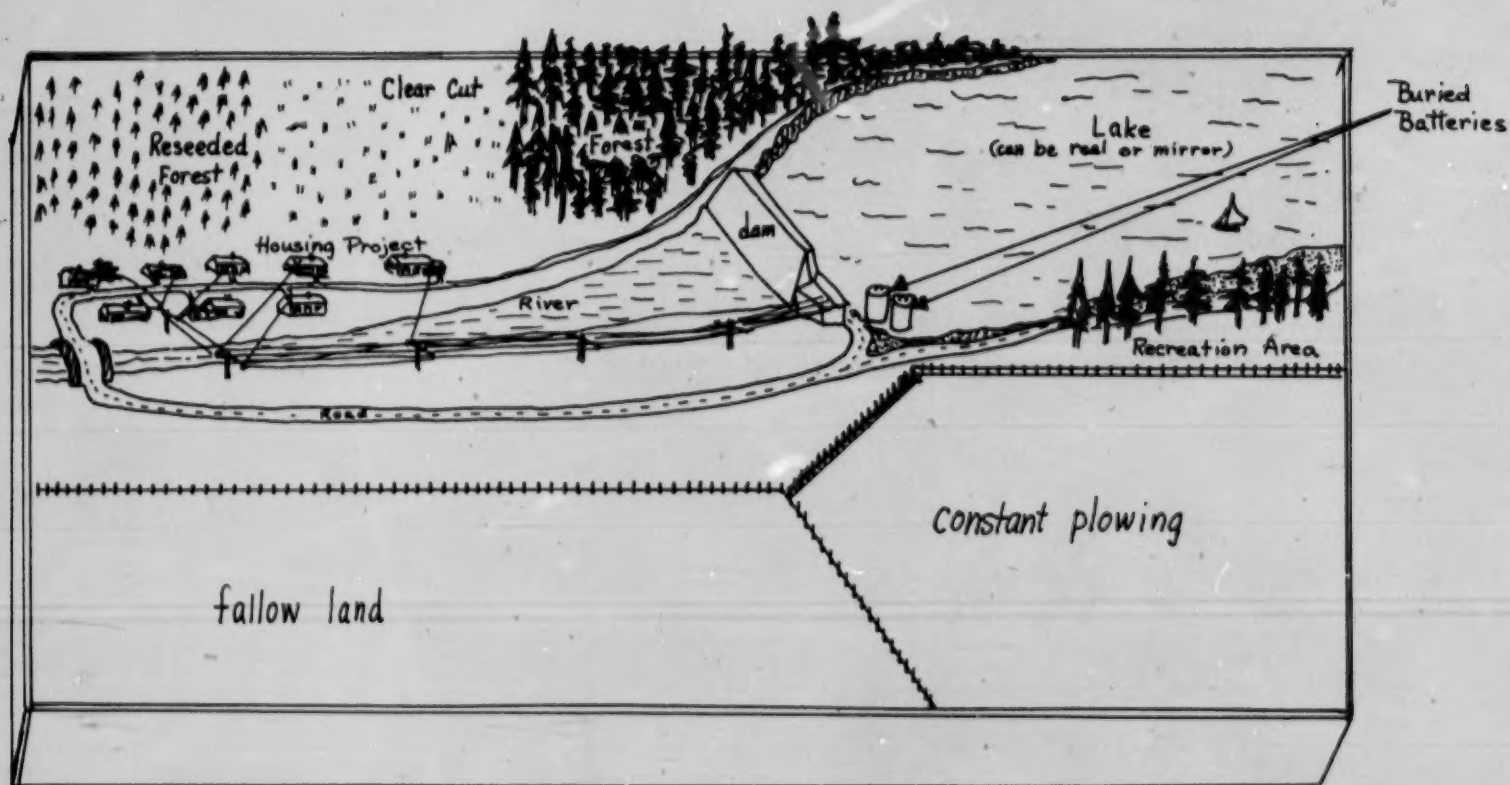
Dirt Box (for conservation unit)

6" sides & ends

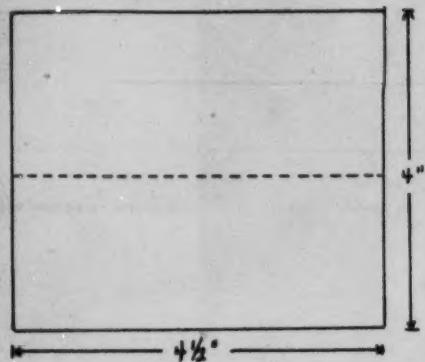
4' x 8' x 1/2" Plywood (bottom)

Dirt Box (recommend dirt as sand is not stable)

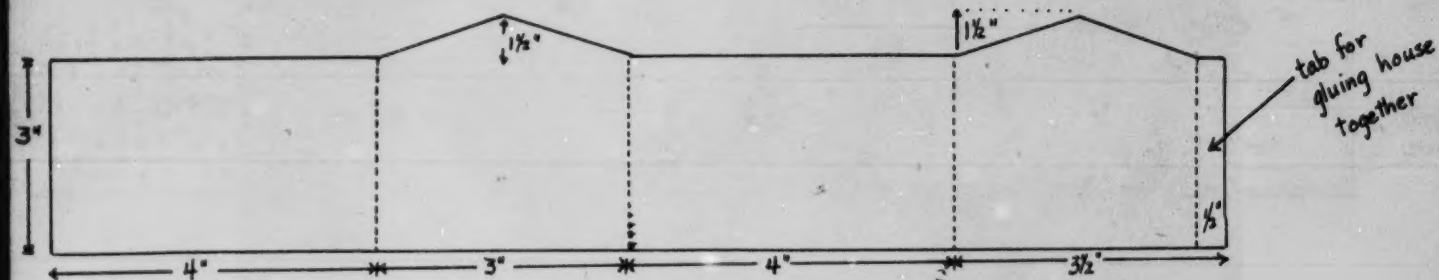
Example Only



Cardboard House

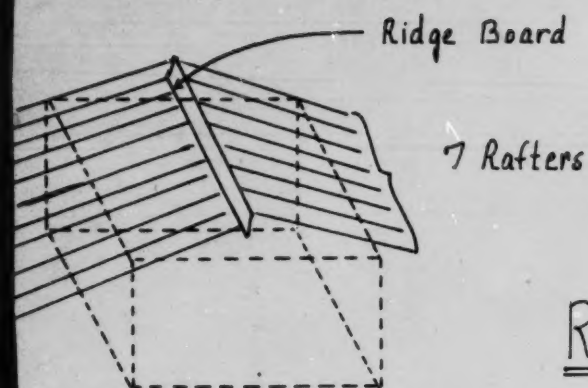


Score on all broken lines to make folding easy

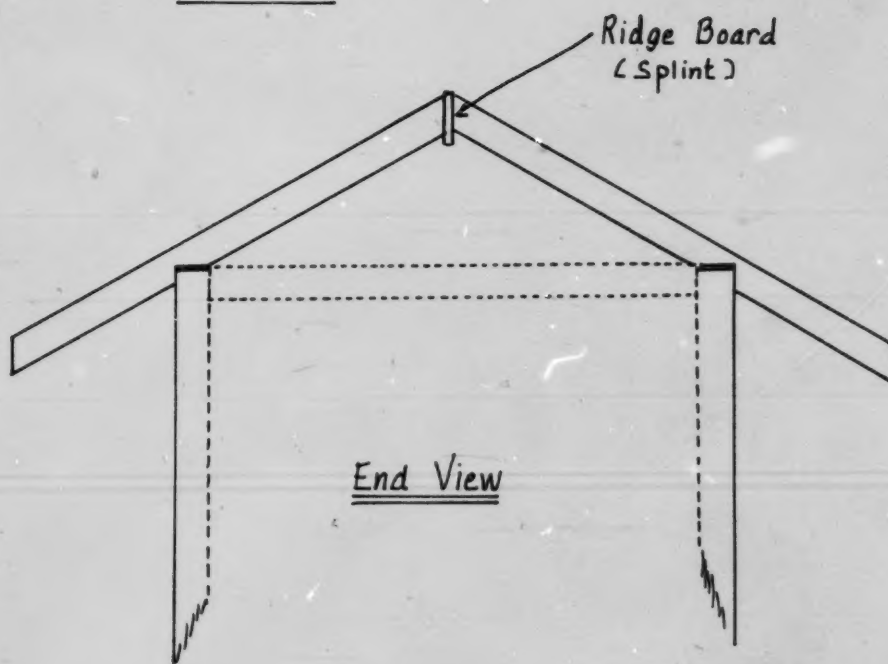


Main Building

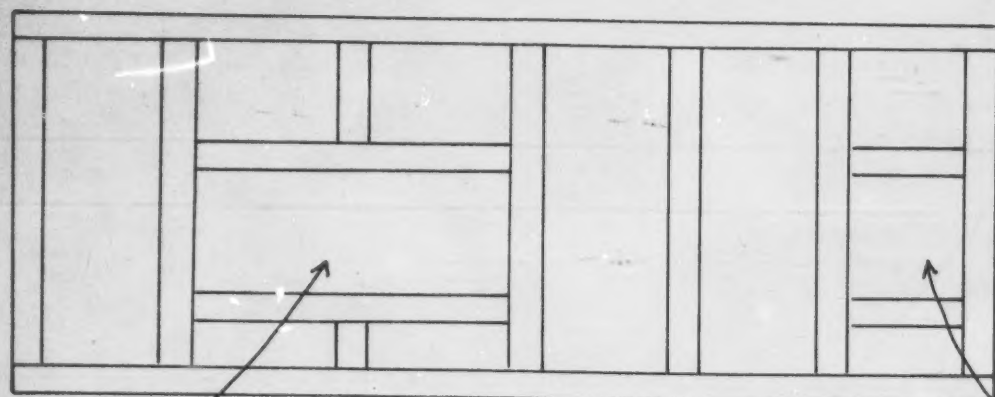
Doors & Windows drawn in wherever desired.



Rafters



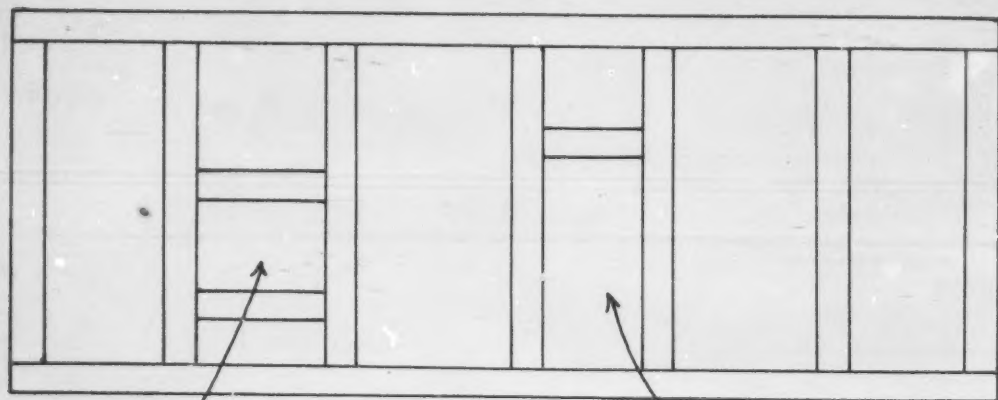
320



Window

Rear View

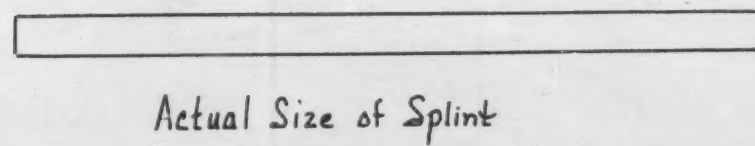
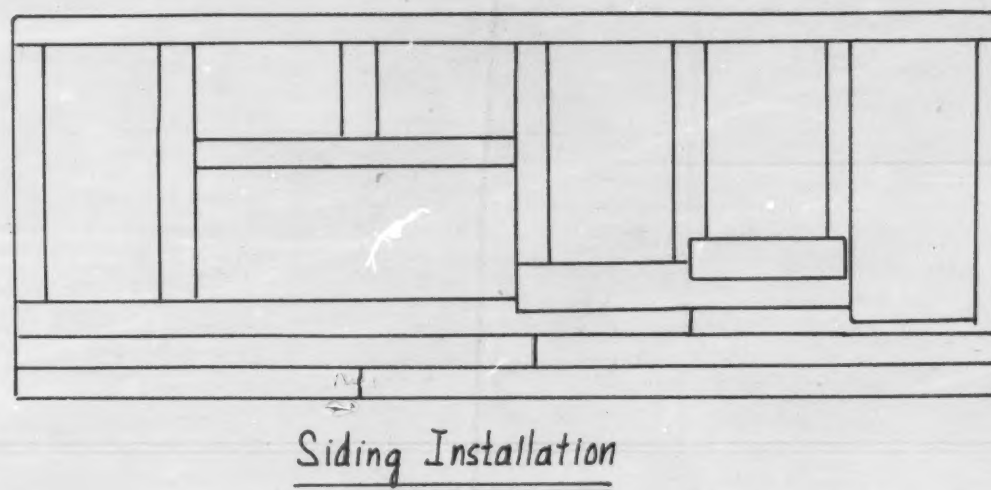
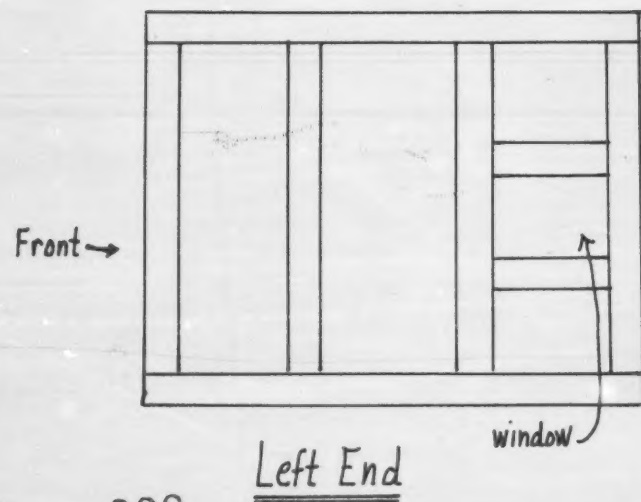
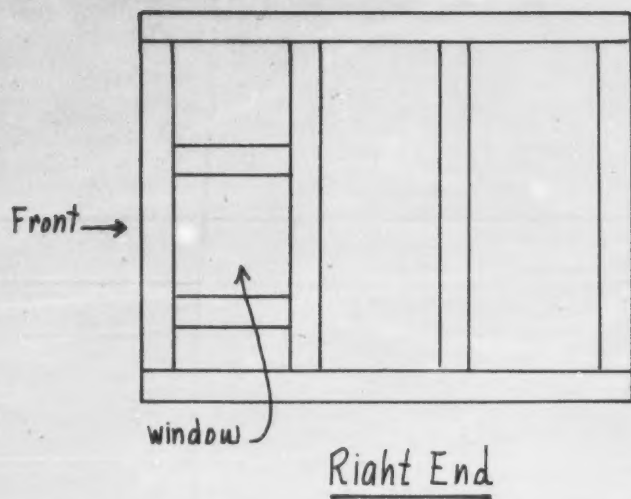
Window

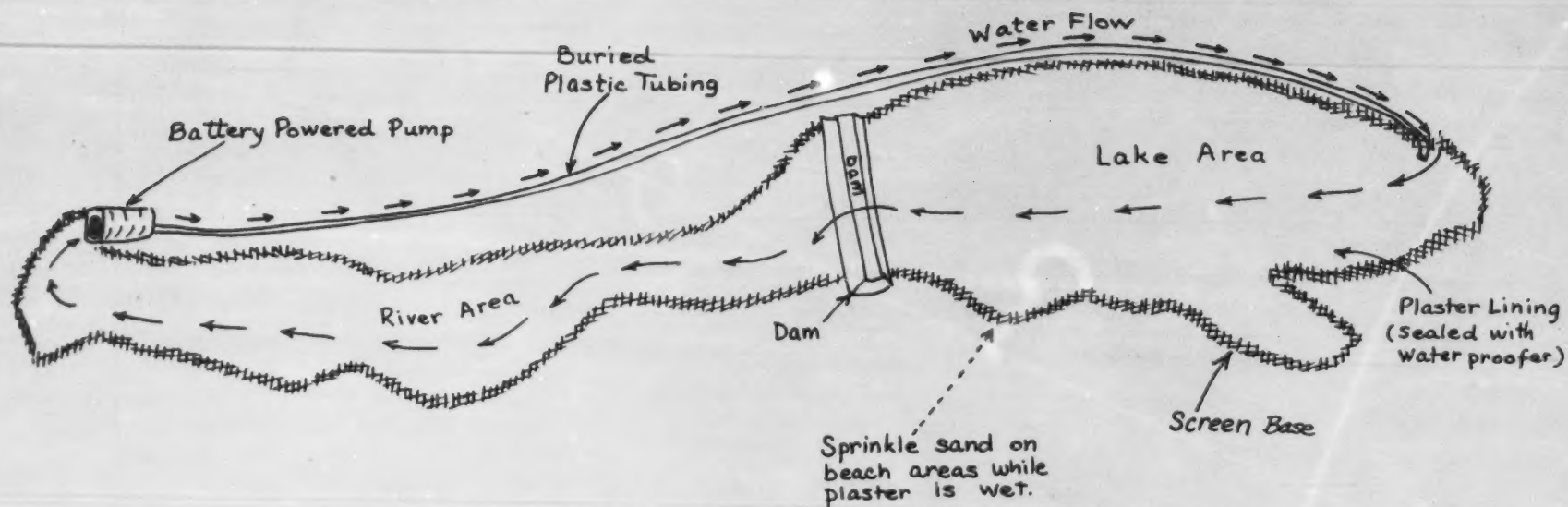


Window

Front View

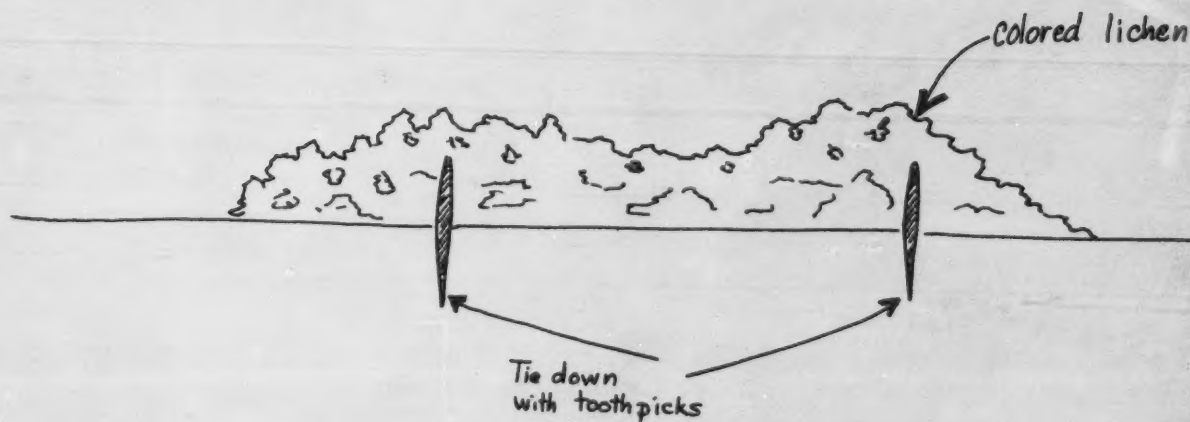
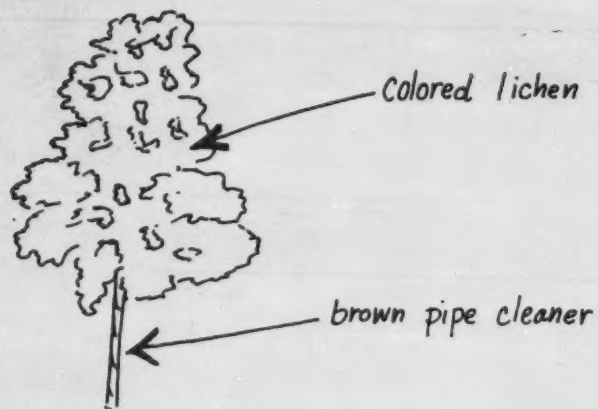
door

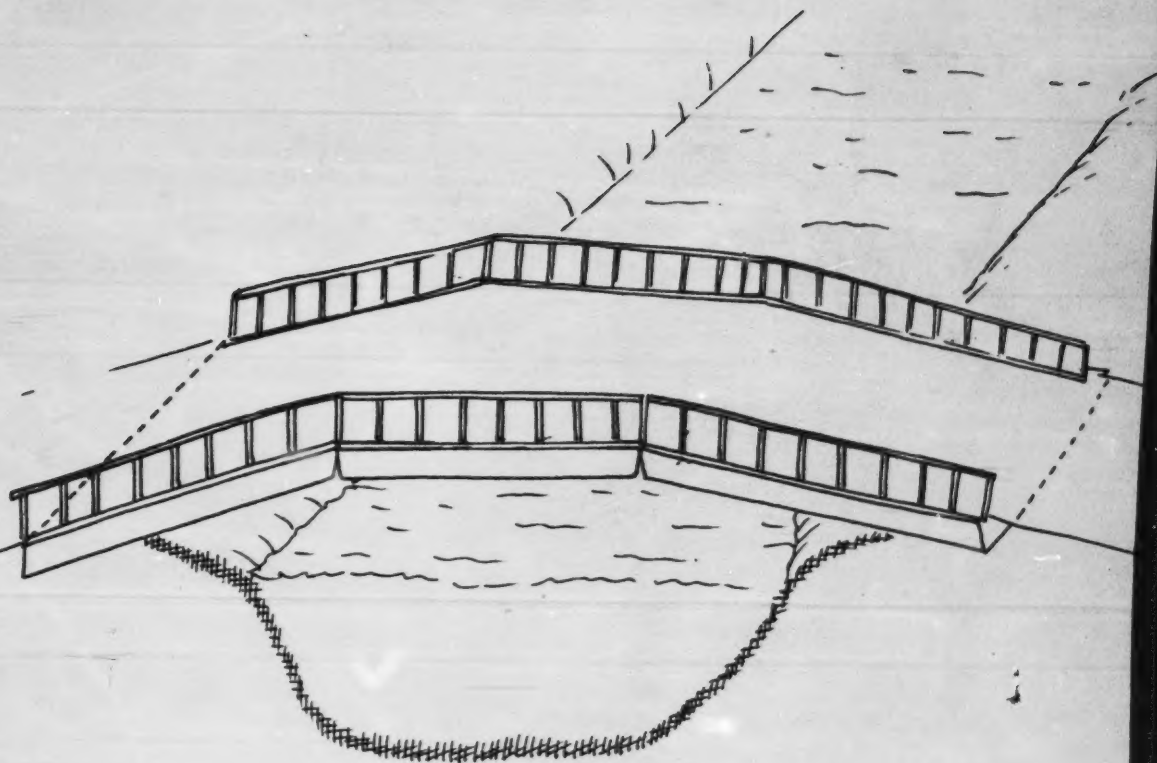




Lake and Stream Construction

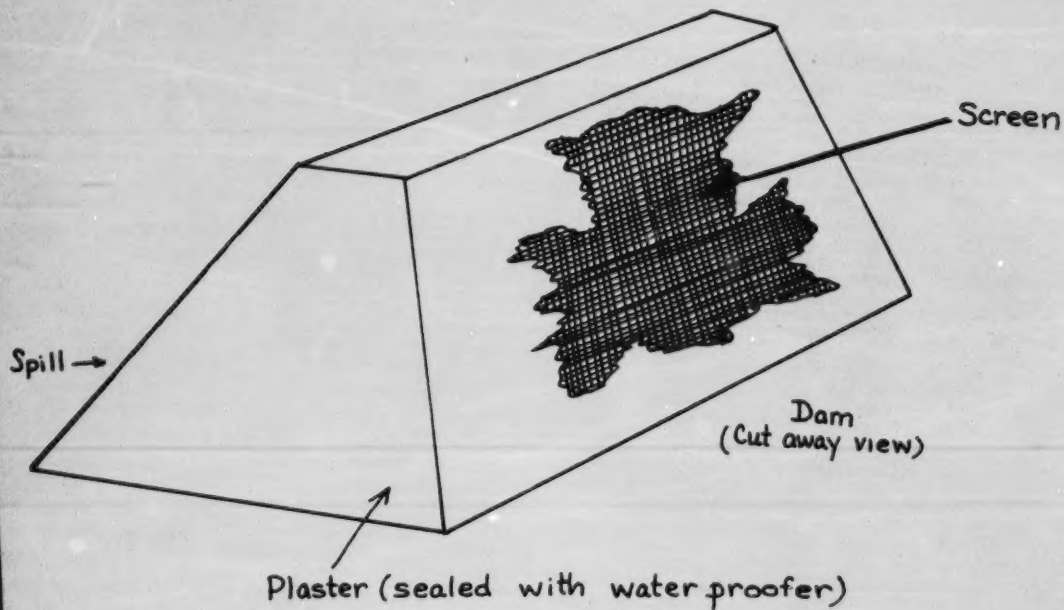
Tree & Shrub Construction





Bridge Construction

Dam Construction



title: "This Land Is My Land!!"



impacts



concept: The use or non-use of any energy source requires environmental trade-offs.

objective: Given the opportunity, the student will recognize that land values and land usage were contributing causes of the Civil War in the United States.

time: 4 - 30 minute sessions

subject matter area: Social Studies, Art

grade: 5-6

implementation:

- Activity:
1. Ask students to observe land for a period of three days and write down the different ways they saw land being used.
 2. Students list observations on board, group them, and give titles to different land uses. Next add land uses that were not actually observed but which students felt should be part of groupings.
 3. Students review land use groupings, divide into small groups and make posters from old magazines showing land use classifications.
 4. Hold a discussion on the events leading to the Civil War. Students identify the value man placed on land use as one of the major causes of the war. (The North was industrial, the South agricultural, leading to many differences in ways of life and to many insoluble problems.)
 5. Show and discuss film "The Neighbors."
 6. Students develop a community survey with the purpose of finding out values the community puts on their land (see attached survey sheet).

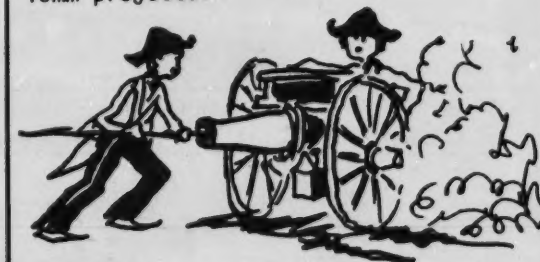
materials:

Butcher paper - 1 piece per group
Old magazines
Glue
Prepared survey questionnaire
Film: "The Neighbors," NBFC 1952



equipment:

16mm projector



implementation:

- Activities: 7. Students compile survey data, record and evaluate responses of the community. (In one survey in Beaverton, Oregon, 87 community members were interviewed; 92% listed land as one of their five most valuable possessions. Of these 92%, 53% listed land as #1.)
8. Students evaluate all activities in lessons 1-7 and discuss the value people have placed on land in our history as well as today in our community.

SUGGESTED CAREER AWARENESS ACTIVITY:

Community life has interested them so much that we now have subdivided our room into lots and the students are purchasing and living on their own plots during school hours (very interesting problems relative to that in community life). You might want to try this!!

**materials:****SUGGESTED ASSESSMENT PROCEDURE:**

Assess students on their knowledge of land uses through making land usage posters.

Verbal responses in number 3, 4 and 5 may be evaluated and correlated.

Community survey sheets and verbal discussions may be used as evaluative tools in number 6.

In number 7, group discussion and response of all individuals will determine success of stated objectives.

At the conclusion of the unit, the students in the original trial class were very enthused about their learning experiences. They are now aware of the many different ways our land can be used, the important part it has played in historical events, and the value their own community puts on land. They especially liked getting involved with the community with their survey.

Developed by: Ronda Eaton
Beaverton School District
Beaverton, OR

Revised by: Dan Grimes
EME

TO OUR COMMUNITY MEMBERS:

We are 5th grade students from Mrs. Eaton's Social Studies class at West Tualatin View Elementary School. In class, we are studying about land, the way it is used, and the value people have placed on it in American history.

We would like to see if people still value land today, and if so, how much value they put on it. To accomplish this, we would like to begin right here in our own community, asking how people feel about their land. We would, therefore, like to ask you a few questions

(Name and address were taken for the purpose of sending thank you notes.)

Name _____

Address _____

1. What things do you possess now that you would hate to give up most?
(limit 5)

2. Now, will you please number your list in order of preference.
3. What steps would you be willing to take to protect your land?

Thank you very much for your time and response.

title: "In The Year 2500?"



Impacts



concept: The use or non-use of any energy source requires environmental trade-offs.

objective:

- 1) The student should be able to compare and evaluate the benefits received from energy use with the environmental consequences arising from alterations necessary to produce it.
- 2) The student should recognize the varying ways that people affects the quality and structure of their environment.

time: 6 - 30 minute sessions

subject matter area: Social Studies, Art, Language Arts

grade: 5-6

Implementation:

- Activity:
1. Play tape on sounds of industry (to be made locally). Have students listen and see if they know what they are. Ask students how the sounds make them feel. Write sentences using comparisons. (This sound is like a _____ because...) Some may find that sounds of industry can sometimes be very disturbing to the ear; furthermore, they may affect the way we feel or perceive something. (Parents might be willing to tape sounds at their work for the class to study.)
 2. Show slides on effects of industrial waste on our water system. Teacher may take pictures, or it would be great if students could break into small groups, go in cars and shoot pictures themselves prior to unit. Discuss reasons for waste and the effect it has now and will have in the future on our environment. (Parents might be willing to take pictures at an industrial site.)
 3. Show film "Ah-Man" and discuss what is happening to our oceans as a result of the constant pollution factor. (Be sure to look towards the future.)
 4. Students are to make pictures entitled "Our Environment in the Year 2500 If We Don't Care."

materials:



Film - "Ah-Man," North American Film, Inc., Post Office Box 219, Tarzana, California 91356

Art paper

equipment:

16mm projector
Slide projector
Tape recorder



implementation:

- Activities: 6. Discuss the many ways our government helps to solve our environmental waste problems. Suggest that the government might use committees to study the problems. The committees would gather evidence and make suggestions to the government. Explain that for the next few days, the students will be given a chance to work as government committees. Step I is to gather evidence (discuss types of evidence they may use: eyewitnesses, statistics, testimony, etc.). Then, explain that one way committees look at this evidence is to hold hearings. Stress that it is very important to look at both sides of the argument. Tell the class that after a day gathering evidence they will hold a committee hearing and listen to the testimony of two groups of people: 1) the industrial owners and 2) environmentalists. Divide the class into two groups representing (1) and (2).
- (Cont.)
7. Use a day to spend gathering evidence. Remind the students of the different kinds of evidence they may use. Each group may tell whether or not they feel our laws are adequate to protect our environment. They may also suggest new laws or ways to solve some of our disposal problems.
8. Begin activity by selecting a student to serve as a committee chairperson. This student will call the witnesses and ask them to explain their positions. When a witness has given his or her reasons for or against a given problem and solution, any committee member may ask questions. After testimony is completed, ask the class as the committee to weigh the evidence. Let them vote on whether or not a law should be passed. Then evaluate the hearing. Point out that one way our government works is to ask the People.

materials:SUGGESTED ASSESSMENT PROCEDURE:

- Assess activity 2 by student participation and sentence completion.
- Assess activities 3-4 by student responses.
- Assess activity 5 on finished art product.
- Assess activities 6-7 in several ways-group participation and student feedback. The testimony given and evidence presented is a very strong evaluative instrument.

Developed by: Ronda Eaton
Beaverton School District
Beaverton, OR

Revised by: Dan Grimes
EME

title: "Land Pollution"



impacts



concept: Energy extraction and use alters original environmental conditions.

objective: Given the opportunity, the student will be able to become aware of the following three sources of human-made land pollutants when given the background information through research and discussion:
1) Metals (vis., iron ore), 2) Wood (plants) and 3) All others (petroleum, etc.).

time: Several sessions

subject matter area: Language Arts, Science,
Social Studies

grade: 5-6

implementation:

VOCABULARY WORDS:

energy
environment
factory
industry
biodegradable
hydro

manufacture
consumer
goods
fuel
by-product
soil waste

modify
landfill
pollutant
mining
impact
"trade-off"

Activity:

1. Introduction. Ask the question, "What do you know about land pollution?" Class discussion should follow.
 - a. List the responses on butcher paper.
 - b. Have students group like items together.
 - c. Have class label the groups.
 - d. Teacher uses this as a diagnosis of what the students know about land pollution and which areas of this unit to stress.
2. Divide students into small groups to retrieve information concerning a list of products made from wood, metals and a list labeled "other." Also have students list six jobs people have in each area. After research, list the information on butcher paper and discuss why wood and metals are used for products.

materials:



Butcher paper
Felt tip markers
Chalkboard
Ditto masters of the handouts attached to this unit.

Films:

"Junkyard," 10 minute color, FA, 1969
"The Garbage Explosion," 16 minute color, EBEC, 1970 (Biology Program Ecology)
"Conservation - A Job for Young Americans," 19 minute color, McGraw-Hill, 1967
"Recycling Waste," 12 minute color, JOUR, 1971

Reference material:

Encyclopedias

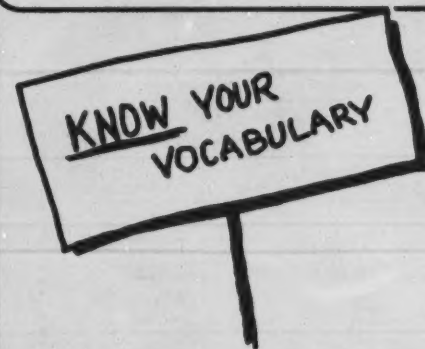
Materials for collages:

Art paper
Magazines
Scissors
Paste



implementation:**Activities:**
(cont.)

3. As a homework assignment, the students are to make a list of wood and metal items (products) that are found in their homes. Also, make a list of the items not made from wood and metal. (Refer to Handout #2). The students should make a folder in which to keep unit work.
4. The following should be a class effort:
 - a. Share and discuss homework assignment from previous activity.
 - b. Introduce the words biodegradable, non-biodegradable short-term and long-term biodegradable. The students should be familiar with these words.
 - c. Using the wood and metal products list from previous activity, discuss which products would be potential land pollutants and which would not. Label each product on the list as you discuss them.
 - d. Ask the question, "Can some biodegradable products cause long lasting land pollution? Why?" Discuss.
 - e. Using the students' homework assignment lists, have them classify the items as either short-term bio, long-term bio, or non-bio. (Refer to Handout #3 which students should keep in notebook.)
 - f. Discuss how students classified the items on their list. (Refer to Handout #3)
 - g. List the products from their school research and homework assignment in the appropriate columns on the butcher paper.
 - h. Questions to be discussed as an outcome of activities 2-4:
 - Should long-term biodegradable products be classified as harmful land pollutants? Why?
 - What have we found out about wood and metal products concerning land pollution? Compare columns on the chart for one answer.
 - What have we found out about the "world of work" concerning wood and metal products? Compare columns on chart for answers.

materials:**equipment:**

16mm projector
Overhead projector



implementation:

Activities:
(cont.)

5. Discuss with class what a land pollutant is. Have students define on paper in their own way what a land pollutant is. (Keep in students' Energy and Environment notebooks.)
6. Have students research for information concerning the different types of factories in the U.S. Students should make a list of the different types of factories (auto, shoe, clothing, etc.).
7. Show films, "Junkyard" and "The Garbage Explosion" and then:
 - a. Discuss films and list harmful effects land pollutants have on the environment. List information on the classroom retrieval chart. (Refer to Handout #1)
 - b. List environmental jobs the class can think of on retrieval chart.
 - c. Discuss what happens to products after man is through using them.
 - d. During art, the students make collages depicting waste, litter and land pollution.
8. Show films, "Conservation: A Job for Young Americans" and "Recycling Waste" and then:
 - a. List solutions for land pollution on the classroom retrieval chart from the films and past study list. (Refer to Handout #1)
 - b. Discuss: "Will your solutions effect the "world of work?" How so?" Introduce the term trade-offs. Ask the question, "Could this be a solution as well?"
 - c. Have students list ways they could help reduce and solve land pollution.

materials:

implementation:



Activities:
(cont.)

9. The class should discuss the following:
 - a. What creates land pollution? List responses on the board.
 - b. Distribute Handout #4 entitled, "An Environmental Impact Cycle." Discuss people's use of natural resources for energy, industry and consumers to indirectly modify the earth's environment by land pollution.
 - c. Have students write a paragraph in their own words describing how energy and people's technology modified the earth's environment by land pollution.
 - d. Discuss: "Are you willing to change your consumer habits in order to decrease land pollution? If so, how? If not, why?"
10. Test and evaluation. (Refer to quiz in Handout #5.)



materials:



SUGGESTED ASSESSMENT PROCEDURE:

Final test and evaluation the students took at the end of the study.

Lists and charts students completed during the study.

"Energy and Environment" notebook each student kept containing vocabulary list.

Art work.

Class discussions based upon teacher's evaluations.

Students answers on evaluative questions are based upon their satisfaction.

This unit provides for an in-depth study of the cause and effect relationship of land pollution. While studying the contents on this unit, the following factors were taken into consideration:

- Mining energy sources.
- Energy conversion for industrial production of goods.
- Consumer use.
- Environmental impact due to mining, industrial and consumer waste.
- Solutions.
- Economics and the "world of work."

Developed by: Dan Grimes
EME

Sample Retrieval Chart
that is made from a long
sheet of butcher paper.

STUDENT RESEARCH RETRIEVAL CHART

Student Handout #1

Land Polluting Products	Land Polluting Industries	Non-land Polluting Products	Non-land Polluting Industries	Harmful Effects of Land Pollution	Man's Solutions	My Solutions
					Environmental	Environmental
					Economic	
Jobs people have	Jobs people have	Jobs people have	Jobs people have	Jobs people have	Jobs people have	My job

After students research for information the teacher records in the appropriate column.

Name _____

Date _____

HOMWORK RESEARCH PRODUCT LIST

Directions: In each column list products you have in your house that are made from wood, metals or other materials.

Items Made From Wood	Items Made From Metals	Items Made From Other Materials

Name _____

Date _____

Student
Handout #3

LAND POLLUTANTS
BIODEGRADABLE, NON-BIODEGRADABLE PRODUCTS LIST

Directions: From your list of manufactured products in your home, place each item in one of the columns below:

Short-term Biodegradable Products	Long-term Biodegradable Products	Non-Biodegradable Products
Biodegrades in a short time. Decomposes fast.	Decomposes at a very slow rate. May take months or years for it to blend with the soil.	Does not decompose in the environment. Does not change

Name _____

Date _____

CAUSE AND EFFECT STUDY

Discussion: How does man change his land environment?

ENVIRONMENTAL IMPACT CYCLE

C
A
U
S
E
S

Factory Fuels

Energy from
coal
oil
gas
hydro
other

power

The Factory

Manufactures
products or
goods for
people to use

transport

Consumer

People buy
the products
from stores

E
F
F
E
C
T
S

Mining the soil
Dams

Soil waste
that isn't
used

Consumer is
through using
product and it
becomes solid
waste

ENVIRONMENTAL IMPACT

R
E
S
U
L
T
S

Mining--Manufacturing--Throwing
away products hurts the land
environment by:
garbage dumps underground mines
junkyards oil wells
landfills dams on rivers
open pit mines litter

LAND POLLUTION QUIZ

NAME _____

DATE _____

Directions: Match the following words on the left with the meanings on the right by placing the letter for the correct answer in each blank.

- | | |
|----------------------|--|
| _____ trade-offs | A. people who buy goods and services |
| _____ energy | B. air pollution |
| _____ environment | C. all the things that surround us |
| _____ biodegradable | D. to change in some way |
| _____ solid waste | E. solid materials that are not used anymore |
| _____ land pollution | F. the ability to do work |
| _____ modify | G. decomposed by living things |
| _____ consumers | H. unclean land |
| _____ by-products | I. a product made along with something else |
| _____ recycling | J. using a product or material over again |
| | K. trading one energy source for another |

Directions: Answer the following questions by placing your answer in the blank provided:

1. Name two of the earth's resources that man uses to make products that may end up as land pollutants.

A. _____ B. _____

2. Name three by-products that are made from wood.

A. _____ B. _____ C. _____

3. Name three by-products that are made from metals.

A. _____ B. _____ C. _____

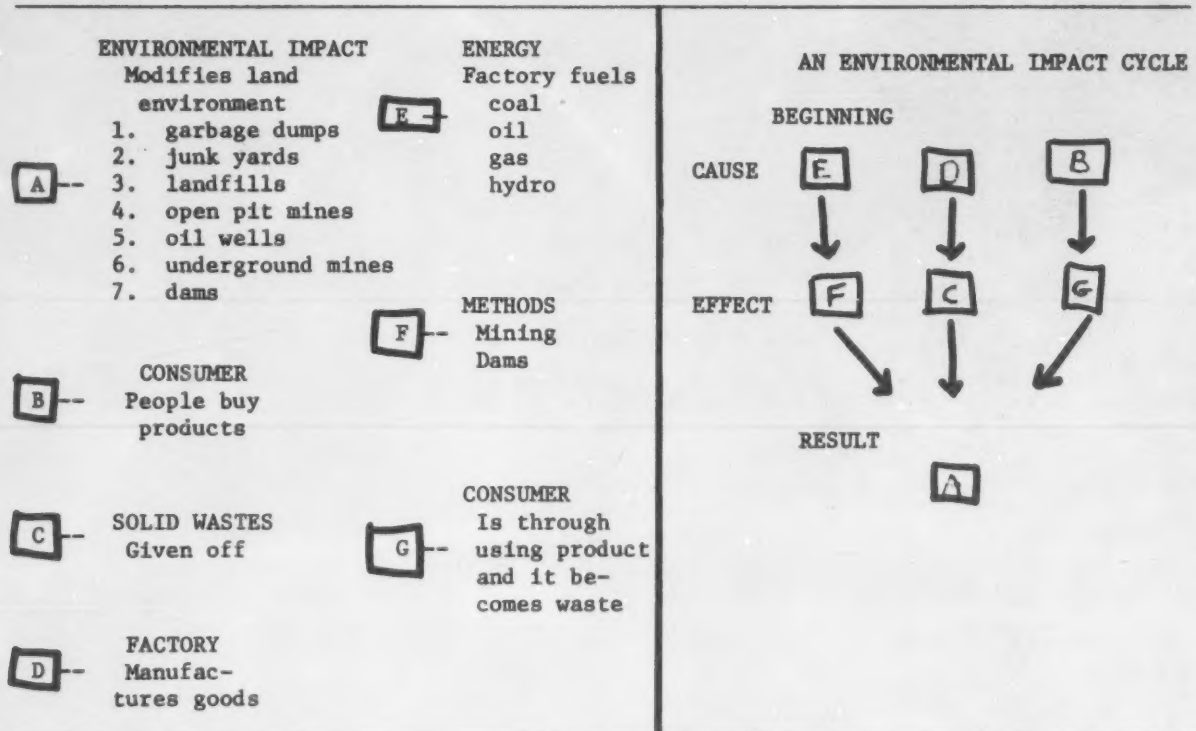
Directions: Below are a number of statements that are either true or false. If the statement is true put a (T) in the blank. If the statement is false put an (F) in the blank.

- _____ 1. A toothpaste factory makes a product that can become a land pollutant.
- _____ 2. An automobile factory makes a product that can become a land pollutant.
- _____ 3. A chilibeau factory makes a product that can become a land pollutant.
- _____ 4. A tin can factory makes a product that can become a land pollutant.
- _____ 5. A plastic factory makes a product that can become a land pollutant.
- _____ 6. A fertilizer factory makes a product that can become a land pollutant.

____ 7. A soda pop factory makes a product that can become a land pollutant.

____ 8. All factories produce goods that can become land pollutants.

Directions: Reproduce the "Environmental Impact Cycle" below by arranging the boxes in the right order. Place the letters in the right box in the chart that is blank.



What might happen if man didn't attack land pollution?

List four things man can do to help solve the land pollution problem.

List four things you can do to help solve the land pollution problem.

Land pollution quiz (con't.)

List two jobs in each area:

Mining _____

Metal industry _____

Wood industry _____

Environmental _____

What can you say about land pollution?

Why must we think of both jobs and the environment when seeking solutions to land pollution?

What did you like and dislike about studying land pollution?

title: "Water Pollution"



impacts



concept: Energy extraction and use alters original environmental conditions.

objective: Given the opportunity, the student will recognize that energy production plants affect environmental conditions.

time: Several sessions

subject matter area: Language Arts, Social Studies

grade: 5-6

implementation:

VOCABULARY WORDS:

energy	by-product	impact
environment	solid waste	"trade-off"
factory	liquid waste	water life
industry	sewage	contaminate
biodegradable	modify	chemical
manufacture	pollutant	water pollution

- Activity:**
1. Introduction. Ask the question, "What do you know about water pollution?" Class discussion should follow.
 - a. List the responses on butcher paper.
 - b. Have students group like items together.
 - c. Have class label the groups.
 - d. Teacher uses this as a diagnosis of what the students know about water pollution and which areas of the unit to stress.
 2. The students are to be assigned a project to discover:
 - a. A definition for water pollution.
 - b. Causes for water pollution.

materials:



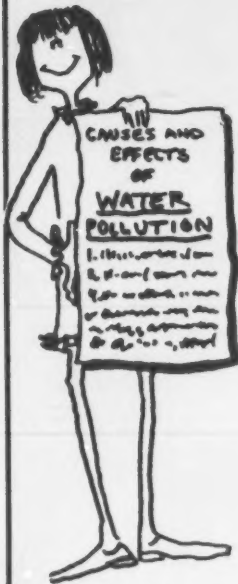
Butcher paper
Felt tip markers
Chalkboard
Pond water
Detergent
Films:

"The Problem With Water Is People," McGraw-Hill, 1964
"Lakes: Aging and Pollution," Centron, 1971
"Life Along the Waterways," EBF, 1951
"Pollution," Argus, 1970
Reference material:
Water Pollution - Causes and Cures, Manufacturing Chemist Association, 1825 Connecticut Avenue, N.W., Wash., D.C. 20009
Clean Air - Sparkling Water, Dorothy E. Shuttlesworth, Doubleday & Company, Garden City, New York City, 1968
Our Environment Rattles, Water Pollution, Renn, Charles, LaMotte Chemical Products Company, March 1969

Implementation:

Activities:
(cont.)

3. The class is to bring information to class for a discussion on water pollution. Ask the questions, "What does it mean? What causes it?" List information on butcher paper.
4. Show film, "The Problem With Water Is People." (30 minutes, color) Discuss.
5. Show film, "Life Along the Waterways." (15 minutes, color) Discuss the film. Set up an experiment: Using pond water, have the students use microscopes to view water life in a drop of water. Discuss what was seen. If possible, identify a few microorganisms. Next, contaminate the water with detergent (one or two drops or a few grains per 200 ml of solution). The next day examine the pond water under the microscope. Any signs of life? Why? Discuss with class the harmful effects of pollutants.
6. Show film, "Lakes: Aging and Pollution." (18 minutes, color) Discuss. (Relate to film in activity 5.)
7. Divide the class into groups to conduct a research assignment.
 - a. Each research group should:
 - Gather information on a specified topic.
 - List their findings on a class retrieval chart.
 - Report to the class orally.
 - Make a list of jobs related to their area of study.
 - b. Suggested topics for group investigation are:
 - Operation of a sewage treatment plant.
 - Types of industries that pollute waterways.
 - Types of industrial pollutants.
 - Harmful effects of water pollution.
 - c. Discuss with students how to go about finding information and give assistance in writing their reports and drawings.

**materials:**

Reference material (continued):

Once There Was a River: A Story of Water Pollution (ecology series),
Scott, Foresman & Company
Encyclopedias



implementation:**Activities:**
(cont.)

- d. Plan a field trip to your local sewage treatment plant.
- e. Plan a trip for a small group or class committee to visit a state environmental official. (Example: Portland, Oregon's DEQ.) Interview him or her about the water pollution problem in the city waterways. Take pictures and tape recorder for interview. Present this information to class.
8. After ample time to complete assignments in activity 7, have students give their oral reports to the class. Using the information from the students' reports and information on the retrieval chart, discuss each of the topics and possible solutions for water pollution.
9. Test and evaluation.

SUGGESTED CAREER AWARENESS ACTIVITY:

Discuss jobs needed to monitor and control water pollution, such as sewage treatment plant operator, ecologist, etc. List these jobs on retrieval chart. Discuss why occupations in industry must be taken into consideration when making decisions concerning environmental quality.

**materials:****SUGGESTED ASSESSMENT PROCEDURE:**

Final test and evaluation the students took at the end of the study.

List and charts students completed during the study.

Class discussions evaluated to norm of teacher's satisfaction.

Evaluation of students' written and oral reports listed in activity 7.

This unit provides for an in-depth study of the cause and effect relationship of water pollution. While studying the contents of this unit, the following factors were taken into consideration:

- Environmental impact of water pollution.
- Why some industries pollute.
- Consumer demands.
- Solutions.
- Economics and the world of work.
- Water treatment plants.

equipment:

16mm projector
Overhead projector
Microscopes

Developed by: Dan Grimes
EME

LIMITS OF ENERGY

GOAL :

IT IS ESSENTIAL THAT EACH
PERSON KNOW THAT THE EARTH'S
RESOURCES ARE LIMITED.



LIMITS

ACTIVITY
DESCRIPTION PAGE
LIMITS (4-6)

Goal: It is essential that each person know that the earth's resources are limited.

Concept: Some energy sources are renewed rapidly while others are renewed so slowly as to be practically nonrenewable.

Activity #1 "Search For Minerals"
Grade level 5-6 Time: 8 - 30 minute
Science, Social Studies, Geography sessions
Given the opportunity, the student will learn that most energy sources are unevenly distributed around the earth.

Activity #2 "What is a Natural System?"
Grade level 4-5 Time: Several sessions
Science
Given the opportunity, the student will demonstrate the knowledge that natural systems directly affect and limit energy sources.

Concept: All sources of energy are limited; most can be used only once.

Activity #3 "The Word 'Limited'"
Grade level 4-5 Time: 3 - 30 minute
Social Studies, Language Arts sessions
Given the opportunity, the student will determine what is meant by the word - "limited" as related to energy resources.

Activity #4 "Conservation Begins With You!"
Grade level 4-5 Time: 25 - 30 minute
Science, Language Arts sessions
Given the opportunity, the student will demonstrate that he can conserve energy and resources at school through an educational program.

Concept: Limitations may be viewed as relative to changing energy demands.

Activity #5 "A Happy Ending"
Grade level 4-5 Time: 2 - 30 minute
Language Arts sessions
Given the opportunity, the student will be able to understand and state what a nonrenewable resource is.

ACTIVITY
DESCRIPTION PAGE

LIMITS (4-6)

(continued)

Concept: Knowledge and technology help develop and extend past, present and future energy resources.

Activity #6 "An Old-Fashioned School Day"
Grade level 5-6 Time: 12 - 30 minute
Science, Social Studies sessions
Given the opportunity, the student will observe the effects that losses of energy sources will cause.

Concept: Population change directly influences energy use, availability and supply.

Activity #7 "Times Are Changing"
Grade level 4-5 Time: 6 - 30 minute
Social Studies sessions
Given the opportunity, the student will investigate the amount of energy needed by the community over a period of years.

title: "Search For Minerals"



limits



concept: Some energy sources are renewed rapidly while others are renewed so slowly as to be practically nonrenewable.

objective: Given the opportunity, the student will learn that most energy sources are unevenly distributed around the earth.

time: 8 - 30 minute sessions

subject matter area: Science, Social Studies
Geography

grade: 5-6

implementation:

- Activity:
1. Students should realize that natural processes are constantly forming and concentrating energy sources, thus determining the location of these energy sources. The following activities will help to develop this concept.
 2. Have the class discuss what is meant by "natural processes":
 - a. Have the students give examples of natural processes. Some examples would be:
 - Coal changing into diamonds after undergoing centuries of heat and pressure.
 - Geothermal energy generated by the decay of natural radioactive materials within the earth. (This is in addition to the heat energy remaining within the earth from the gravitational formation of the earth.)
 - Oil formed from the decay of ancient vegetation. (Fossil fuels: gas, oil, coal.)
 3. Have the students write to their state department of natural resources for information on the state's resources and their location.
 4. Have each student draw a state map, identifying and depicting the location of the state's principal mineral resources.

materials:

Butcher paper for charts.



implementation:



Activities: 5.
(cont.)

Have students divide into groups of four or five. Either assign, or have each group choose, a continent, for research on that continent's major minerals, energy sources, and their location.

a. Have each group of students draw a large map of their continent, naming and locating the major minerals. Each map must be accompanied by a key. (The teacher might also require a bar graph showing the percentage of each mineral located on each of the continental maps.)

b. Atlases in the school library will provide the information needed for this activity.

6. Post the completed maps around the classroom. Ask the students to compare the maps. Which minerals/energy sources are predominant on each continent? Which are less common? Are these sources evenly distributed throughout the world? How would you explain this? (This discussion may be expanded upon as the teacher desires. One may or may not want to get into the subject of the effect of energy-source distribution on international relations.)

SUGGESTED CAREER AWARENESS ACTIVITY:

Have students identify jobs involved with the use of the major minerals found in their research.

materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity to research and map each continent's energy sources, discuss and graph the results, and depict the energy sources of one's state, the student should demonstrate a knowledge that the earth's energy sources are unevenly distributed.



Developed by: Shirley E. Barnes
Beaverton School Dist.
Beaverton, OR

Revised by: Dan Grimes
EME

title: "What is a Natural System?"



limits



concept: Some energy sources are rapidly renewed while others are renewed so slowly as to be practically nonrenewable.

objective: Given the opportunity, the student will demonstrate the knowledge that natural systems directly affect and limit energy sources.

time: Several sessions

subject matter area: Science

grade: 4-5

implementation:

- Activity:
1. For discussion, ask the question, "What is a natural system?"
 - a. Students should arrive at the conclusion that a natural system is not artificially made, but is a cycle or system in nature. (e.g. watercycle, carbon cycle, oxygen-carbon dioxide cycle, etc.) See enclosed chart on cycles in an ecosystem.
 2. Have the students work in groups to research and give oral reports, using pictures and diagrams, on the following natural cycles:
 - a. The oxygen - carbon dioxide cycle.
 - b. The carbon cycle.
 - c. The water cycle.
 - d. A food chain.
 - Appropriate films and filmstrips could be used. See film suggestions under "Materials."
 3. Have the students use three one-gallon glass jars in order to make three terrariums. (Often these jars may be obtained from the school cafeteria.) Have the students perform the following in order to see the effect natural systems have upon the energy in an ecosystem:

materials:



Three one-gallon jars.
 Plastic wrap to cover the jars.
 Rubber bands
 Gravel
 Charcoal
 Potting soil
 Sand
 Plants
 Enclosed chart on natural systems.
 Available films or filmstrips on natural systems.

Film or filmstrip (suggested):
 "Water," Part I (filmstrip) Ward's 1966.
 "Balance of Life & the Space Age," 14 minutes, color, FA 1964



implementation:**Activities:**
(cont.)

- a. Place gravel and charcoal in the bottom of the gallon jars. (A briquette or fireplace charcoal may be used.)
 - b. Mix and add potting soil and sand. (Obtain sand from a river, if possible, as it will contain more humas material.)
 - c. Obtain plants to place into two of the terrariums. If plants from the woods are used, then soil from the woods should also be used in the terrarium.
 - d. Place plants in only two of the terrariums.
 - e. In the third jar, follow only steps a and b. Do not add any plant life. Construct the three terrariums exactly the same except that the third terrarium has no plant life added.
 - f. Water the three terrariums adequately and place clear plastic wrap over the tops. Hold the plastic wrap in place with a rubber band.
 - g. Place one of the terrariums containing plants where it will receive adequate sunshine but not so much heat that it will dry out.
 - h. Place the other terrarium containing plants in the dark.
 - i. Place the third terrarium, in which the students did not place any plants, in a sunny position, similar to terrarium #1.
4. Have the students observe and record data on the three terrariums. What happens to the water cycle in the three terrariums? Is the sun's energy a necessary part of the water cycle? Why? Do plants grow in the third terrarium even though none were planted? Why? (In most cases plants will grow, because the soil is not sterile.) Of course, these questions and activities may be expanded.

materials:

implementation:



Activities: 5.
(cont.)

Follow up: Have the students respond orally or in writing to the following questions.

a. What effect does lack of rain, or change in our water cycle, have on our energy supply? (For example, in 1973, low rainfall in the Pacific Northwest caused low water levels, which in turn caused shortage in hydroelectric power.)

6. This concept may be further expanded upon by asking students to write essays or use diagrams to illustrate what results, including effects upon the energy supply, would occur if interruptions were to take place in the other natural systems shown in the enclosed diagram. (e.g. What if so much of the plant life was destroyed that the oxygen-carbon dioxide cycle or the food chain became seriously affected? What far-reaching events would take place?)

SUGGESTED CAREER AWARENESS ACTIVITY:

Invite a meteorologist or greenhouse keeper to class to tell about his/her job and to explain the water cycle in relationship to the earth.

materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity to make oral reports, draw diagrams and pictures, and interpret data, the student will be able to demonstrate an understanding of the fact that natural systems directly affect and limit energy sources.

Developed by: Shirley Barnes
Beaverton School Dist.
Beaverton, OR

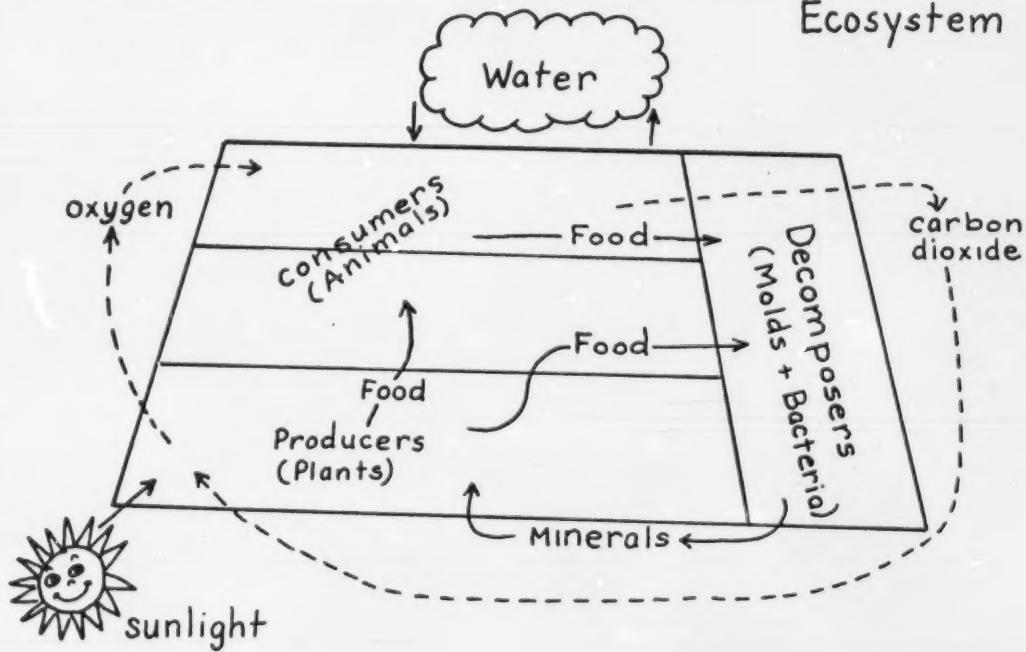
Revised by: Dan Grimes
EME



activities



Cycles in an Ecosystem



Adapted from SCIS

title: "The Word 'Limited'"



limits



concept: All sources of energy are limited; most can be used only once.

objective: Given the opportunity, the student will determine what is meant by the word "limited" as related to energy resources.

time: 3 - 30 minute sessions

subject matter area: Social Studies, Language Arts

grade: 4-5

implementation:

- Activity:
1. The teacher will explain the word "limited" and give various examples of resources that are limited. Once the students catch on, have them give a few examples of resources that are limited.
 2. Have the students develop a plan to conserve a limited resource by:
 - a. dividing the class into five (5) groups.
 - b. assigning each group a resource that is limited in classroom supply.

Examples: Group I. Situation
Each student is only allowed to use two sheets of notebook paper for the day. It is your responsibility to develop a plan for the class on how to best use the paper for all subjects requiring written assignments for the day. Also, be able to explain to the class how each member can conserve or ration paper since the resource is limited.

(The teacher might explain to this group that a (hypothetical) notebook crisis has hit and the resource is soon to run out. Scientists are working hard to find a substitute, but it will take a long time.)

materials:



Notebook paper
Staples and stapler
Pencils
Box of chalk



implementation:



Activities: Group II. Situation (cont.)

Pencils are limited - come up with a plan how students can best conserve their pencils.

(The teacher explains to this group that a (hypothetical) pencil crisis has hit and a conservation plan is needed. Scientists are working hard to find a substitute, but it will take time.) List alternatives to substitute for pencils.

Group III. Situation

The teacher explains to this group that a (hypothetical) water shortage has developed in the town and a conservation plan is needed in the classroom to help save water when using the drinking fountain.

Group IV. Situation

The teacher explains to this group that a (hypothetical) chalk supply shortage has developed. Give the group a box of chalk and tell them that this is all that is left for the year. Have them develop a plan how to best use the limited supply of chalk and also to suggest alternatives that could substitute for chalk.

Group V. Situation

Staple shortage has occurred. Give the students a loaded stapler and explain that this is all that is left. Have the group develop a conservation plan and list alternatives to take the place of staples since the source is limited.

materials:



implementation:



Activities: (cont.)

After the groups have developed classroom conservation plans, have them presented to the class bringing in these points.

1. The source is limited.
2. Ways to conserve.
3. Alternative sources that could be used to replace the limited one.

At this point, the students should realize what the word "limited" means. Explain to the class that most energy resources are limited too and conservation plans and alternative energy sources need to be developed. List on the board the energy source, "gasoline." Through class discussion determine why the source of energy is "limited." List ways to conserve gasoline and list alternatives for replacing it when the source is gone.

Optional Activities: Write a creative story, "The Day The Gasoline Ran Out."

SUGGESTED CAREER AWARENESS ACTIVITY:

Invite a local service station owner to the class to talk about his/her job and about gasoline being a limited resource. What will he/she do when the gasoline is all gone?

materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, the student will be able to define verbally or written the word "limited" and relate it to energy resources.



Developed by: Dan Grimes
EME

title: "Conservation Begins With You!"



limits



concept: All sources of energy are limited; most can be used only once.

objective: Given the opportunity, the student will demonstrate that he can conserve energy and resources at school through an educational program.

time: 25 - 30 minute sessions

subject matter area: Science, Language Arts

grade: 4-5

implementation:

- Activity:
1. Have students brainstorm, listing all the resources that are used at school (lights, water, food, metal in building, paper supplies, heat, all electrical energy used, window glass, etc.).
 2. Collect all resource material available for them to search for the sources of the resources they have listed. A list of resources made from student lists could be written on the board as a common list for the class.
 3. After the sources of the resources are located, challenge students to find the availability of these resources. Is an unlimited amount available? Show film "Home" or use substitute.
 4. Conduct a discussion that will bring the facts regarding numbers 2 and 3 to the students.
 5. Pose questions: "What can we do to help conserve these resources at school?"
 6. Write these factors on board and make copy for each student as a checklist.

materials:



Variety of encyclopedias.
Up-to-date reading material on resources (newspapers, magazines, texts).

TV viewing
Checklist of ways to conserve energy and resources.

Film:
"Home," available through any U.S. Park Service Regional Center.

implementation:



- Activities: (cont.)
7. Have students check the list of ways they can conserve resources at school each day for a two-week period.
 8. Culminate study by reviewing each persons' checklist and reviewing responsible action as a class.
 9. Continue emphasis and discussion through year and suggest they carry out the learnings at home.

SUGGESTED CAREER AWARENESS ACTIVITY:

Invite any parents whose jobs are directly related to producing any of the resources used at school, to visit the class to speak about his/her job.



materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, the student will identify at least five (5) resources used at school and five (5) ways that resources can be conserved.

Developed by: Vern Clegg
Cottonwood Heights
School
Salt Lake City, UT

Revised by: Dan Grimes
EME

title: "A Happy Ending"



limits



concept: Limitations may be viewed as relative to changing energy demands.

objective: Given the opportunity, the student will be able to understand and state what a nonrenewable resource is.

time: 2 - 30 minute sessions

subject matter area: Language Arts

grade: 4-5

implementation:

- Activity: 1. See attached sheet.
2. An area large enough to implement the activity needed. There are nine characters, so an average classroom would do. If you wish, each child could have a sign attached to him/her to indicate the part he/she plays. The play can merely be read or can be practiced and then put on a tape recorder.

SUGGESTED CAREER AWARENESS ACTIVITY:

Invite a high school drama student or an adult to talk about drama play acting. He/she might demonstrate a few techniques on how to verbally deliver the script to an audience.



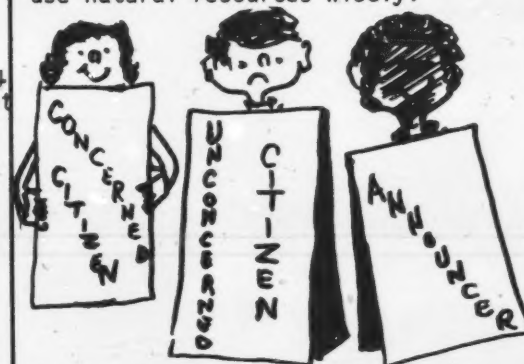
materials:



A copy of the play.

SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity to play act an energy skit, the student will be able to list ways why it is important to use natural resources wisely.



Developed by: Kay Waskey
Cheyenne, WY

Revised by: Dan Grimes, EME



activities



Student Handout

A HAPPY ENDING

This play can be produced on a stage or as a radio program. It can be taped and played back to the class as another learning experience.

CHARACTERS

Aluminum
Coal
Copper
Iron
Natural Gas
Petroleum
Concerned Citizen
Unconcerned Citizen
Announcer

- ANNOUNCER:** This is a make-believe story about the world's nonrenewable resources; that is, resources that cannot be replaced once they are used up. It could never happen in real life because nonrenewable resources cannot talk, but we think if they could this would be what they would say to us.
- Our story opens up in a museum where aluminum, coal, copper, iron, natural gas and petroleum are on display in a case labeled "nonrenewable resources."
- COAL:** Do you guys realize that I'm only going to be around for another century or two and then I'll be all used up...I'll be all gone.. depleted, if people don't change their ways!!
- ALUMINUM:** Depleted! What in the world does depleted mean?
- COPPER:** That means used up and destroyed forever. I might be depleted too. That makes me very sad because I have done so much for people since I was discovered. Why, I am even put in money now because our friend silver is almost all gone.
- IRON:** Yes, I might be depleted sooner or later too.
- NATURAL GAS:** And I might be depleted someday too.
- PETROLEUM:** I've only got decades to go too, if people aren't careful.
- COAL:** Wow, I never thought I'd see the day when our jobs might finally be over. And do you realize that none of us can be produced by people?
- PETROLEUM:** Yes, and it took millions of years to make us and we might be gone before you know it. I just wonder what people plan to do if we are all used up?



activities



A HAPPY ENDING

(continued)

- NATURAL GAS:** Yes, so do I! I don't think people have even begun to realize what we do for them and what will happen if we are gone. Why, I help heat homes, run stoves, help to run factories and many more things.
- COAL:** Yes, I also heat and run homes, factories, schools, hospitals, office buildings and many more things. I'm also used to supply big power plants with energy so that they can produce electric power for many homes, towns, and big cities. I'd like to see people use me wisely.
- PETROLEUM:** How about me? Without petroleum, people couldn't run cars, buses, trains, planes, motorcycles, and any other thing with an engine in it. I also help make cosmetics and many synthetic materials.
- IRON:** Without me people couldn't build skyscrapers and bridges, hospitals, schools and churches. I just wonder if people know exactly what they are headed for?
- COAL:** I don't know, but here come two of them now. Why don't we ask them?
- CONCERNED CITIZEN:** (Walking toward the display of nonrenewable resources.) Boy is this ever a nice museum! I really had no idea they could put so much material into a museum about Energy and Man's Environment. Isn't it just great!
- UNCONCERNED CITIZEN:** Ya, I guess so if you dig this sort of thing. Me, I'd rather be at the beach enjoying the sun and surf. Of course, with the gas shortage and all I can't drive to the beach, so I guess I'll have to settle for second best. That's life!
- CONCERNED CITIZEN:** Yes, that's life, but I just wonder if there isn't something we can do about it. You know for years we have used all our natural resources without thinking that maybe someday they would be used up. I hope maybe it isn't too late to start doing something about it. I already am trying to conserve by turning my thermostat down to 68 degrees, by riding my bike instead of driving my car everywhere, and driving 55 mph on the highway. But I'm sure there must be many more things I can do.
- UNCONCERNED CITIZEN:** Ya, I suppose so but I figure there are enough other people conserving that if I don't it won't matter.



activities



THE HAPPY ENDING

(continued)

CONCERNED
CITIZEN:

Hey, look over there! There's a display of nonrenewable resources. Those are resources that can never be replaced. This ought to be interesting. Come on; let's go! (They walk over to the display and look down on it.)

COAL:

Hello there. (The two citizens look around shocked, then focus their attention on the piece of coal.)

Concerned
Citizen:

Hey, did you hear that peice of coal say something?

COAL:

Of course I said something. Isn't it about time we non-renewable resources said something to the objects that are destroying us?

CONCERNED
CITIZEN:

Yes, I suppose so, but I just never thought I'd hear a piece of coal talking to me. I've used you for years to heat my home, but I certainly never carried on a conversation with you before!

COAL:

That's the whole point! You've used us for years, but you never stopped to think and understand what is happening to us. Do you realize that all of us in this display-case might be completely used up! Destroyed! Gone?

UNCONCERNED
CITIZEN:

Big Deal! So what! Scientists have saved us before, so why can't they do it again? We don't need you, because I'm sure we'll find something else to take your place.

PETROLEUM:

This could very well be, but I wouldn't count on it. Scientists are now working on all sorts of forms of energy such as geothermal, solar and nuclear energy, but they all have problems that have to be worked out. Besides, what you and so many other people don't realize is that all of us are used in a lot more ways than you can even imagine. Did you know that I'm used to make all of the beautiful snythetic fabrics we have today and that without me our factories couldn't run to produce those materials?

ALUMINUM:

Yes, and did you know that I am found in such things as doors, toys, car parts, boats, bicycles, rocket fuel, street signs, knitting needles, jewelry, Christmas tree tinsel, mobile homes, and many many more things you haven't even thought about? Can you imagine how hard it would be to even start to find a replacement for all these things?

IRON:

Yes, and do you realize how many jobs our industries provide for people? Why, we provide jobs for miners, arch.tects, geologists, metallurgists, market analysts, bookkeepers, data processors, secretaries, personnel managers, advertising

LIMITS



activities



A HAPPY ENDING

(continued)

specialists, and many many more.

COPPER:

Hey, how about me? I carry electricity from generating plants to all our homes, schools and businesses. I just wonder what will happen to people if all of us are used up. Do you have any ideas at all about what is going to happen?

UNCONCERNED
CITIZEN:

I never really thought about it before, but I just always thought that science would invent anything we needed. I never thought that maybe we would run out of the things we need to invent new things! That's really something to think about.

CONCERNED
CITIZEN:

You're right, and it's about time we started thinking about it and doing something about it. (Turning to the display of nonrenewable resources.) Do you guys have any suggestions?

ALUMINUM:

Yes, I have one. Instead of throwing away things that are made out of me, such as used cans, old toys, aluminum doors, and many more things, save them and recycle them. You know some cities have places where you can sell me back again to be used over and over again.

COAL:

You can make me last longer by being very careful about using electricity. Don't run electrical appliances when it isn't necessary, turn out lights when you leave a room, turn down your thermostat to 68 degrees, keep your house closed up when using an air conditioner, keep your house well insulated so heat won't escape and never use electrical power unless it is really necessary. I'm sure you can think of many more things if you really think about it.

COPPER:

I can also be recycled or used again just as aluminum can. I really wonder how much of me can be found in old junkyards and garbage dumps?

IRON:

I too can be recycled and made into brand new things like car parts and parts for almost all kinds of machines and equipment.

NATURAL GAS:

I can be conserved in the same way coal is; by taking it easy and being very, very careful with the things I help run. For instance, people can save gas by always running a full load of clothes in a gas washer and hanging their wash outside when possible instead of running their gas dryer. Also, you can save gas by always making sure all of your gas appliances are in perfect running order.



activities



A HAPPY ENDING

(continued)

PETROLEUM:

I guess most people think of me when they think of cars, but I also do many more jobs. They make liquid gasoline, oil, and kerosene out of me. I help all kinds of machines work, I oil hinges in doors, and I run cars. If people drove 55 mph, only drove their cars when it was necessary and rode in car pools to work, it would really help conserve me. I think we would all agree that we must all do all we can to help, because when everyone works together things always seem to work out for the best.

CONCERNED
CITIZEN:

Yes, I agree completely, don't you? (Talking to his friend.)

UNCONCERNED
CITIZEN:

Well, I know one thing; I'm going to do all I can to help because I sure don't want to lose all our friends here. I wish I had started sooner, but maybe it's not too late.

CONCERNED
CITIZEN:

Yes, maybe it's not too late after all. If we all work together we still can have a good world to live in.



title: "An Old-Fashioned School Day"



limits



concept: Knowledge and technology help develop and extend past, present and future energy resources.

objective: Given the opportunity, the student will observe the effects that loss of energy sources will cause.

time: 12 - 30 minute sessions

subject matter area: Science, Social Studies

grade: 5-6

implementation:

- Activity:
1. School Day 1874. This activity could be carried on school-wide or by an individual class. To dramatically illustrate the limits of energy, plan a day without heating, lighting, or prepared food. Give the students opportunities to discuss auxiliary sources of light and heat, hurricane lamps, candles, warmer clothing, slates instead of paper, and food of their own preparation.
 2. This activity needs planning time, beginning two weeks before the actual day of reenactment.
 - a. First, list the energy sources that would not have been available 100 years ago.
 - b. What are the consequences of doing without and what auxiliary materials could be used?
 - c. What was school like 100 years ago? (This provides for unlimited research, who was president, what was the teacher like, what subjects were taught, who, indeed went to school?)
 - d. How would a school room differ 100 years ago? Wall decorations, perhaps removal of desks for tables and benches, lamps and candles, slates, or pen and quill?

materials:

Paper or tagboard for classroom list.



implementation:

Activities: 3.
(cont.)

The reenactment of "School Day 1874" should be set up the day before, so that activities begin upon the student's arrival. From research done beforehand, the classroom will take on the aspects of one 100 years ago, and the students will live that day of life different from their own and will feel the effects consequent to losing sources of energy.

Optional Activity: Students will write their feelings about their "day in the past" to be shared with other classmates.

SUGGESTED CAREER AWARENESS ACTIVITY:

Have students compare and contrast the job of a teacher 100 years ago to that of one today.

**materials:**

SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, the student will compare and contrast the energy use of yesterday compared to that of today.



Developed by: Suzanne McCandless
Medford, OR

Revised by: Dan Grimes
EME

title: "Times Are Changing"



limits



concept: Population change directly influences energy use, availability and supply.

objective: Given the opportunity, the student will investigate amount of energy needed by the community over a period of years.

time: 6 - 30 minute sessions

subject matter area: Social Studies

grade: 4-5

implementation:

- Activity:
1. The following activities will help the students understand the influences which population change has on energy use, availability and supply.
 2. Have the students study a detailed map of their state. Locate the more populous areas on the map. What can be discovered about the locations of these cities? Could there be a direct relationship between the location of the cities and ready access to an energy source? (e.g. Many towns started around streams and/or rivers, due to the availability of the water for transportation and for use of the water wheel to generate power.)
 - a. What happens as the population of an area increases? (The need for energy increases. Therefore people must either reduce the amount of energy they are consuming, develop a more efficient system, or develop a new source.)
 - b. What happens as the population of an area decreases? (The demand for energy decreases, therefore increasing the availability of energy for use by the people in that area, or the excess energy may be transported to other areas.)

materials:

Films (suggestions):
"Population Ecology," 19 minutes,
color, EBF, 1961, JH.



implementation:



Activities: (cont.)

- c. What are we, in the United States, doing as increase in population causes increased energy demands? Examples of possible responses:
 - Conserve energy (carpool, use more insulation in homes, recycle, etc.)
 - Explore other energy sources such as geothermal, solar, nuclear.
3. Have students trace the development of their community and related energy demands from 1800 to the present.
 - a. Use available films and/or resource people to show or tell about the early history of the community.
 - b. Take a field trip to the local museum.
 - c. Have the students incorporate knowledge gained from these activities into a notebook or a mural.
 - d. Have the students list the various sources and amounts of energy used during early community life and compare this with a list of sources and amounts of energy being used in the present community.
4. Have the students compare the amount of energy consumed in several other cities in their state. Is there a significant difference in energy consumption between large and small cities; between non-industrial and industrial cities?
 - a. Have the class discuss the enclosed transparency, (taken from Power Generation Alternatives, by Seattle City Light) showing U. S. Energy History. (Total national energy consumption has tripled in the last 100 years.)
 - b. What has caused this increase?

SUGGESTED CAREER AWARENESS ACTIVITY:

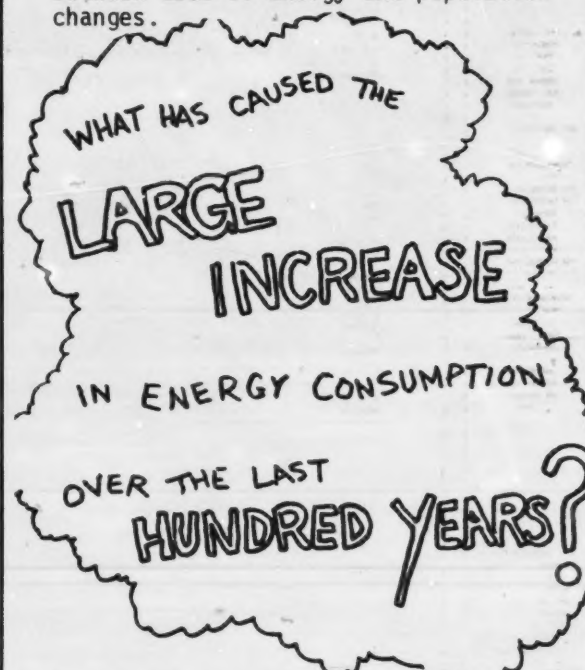
Invite a grandparent to class and have him/her tell what it was like years ago regarding energy uses.

materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity to participate in class discussions, create a mural or personal notebook on information gained, the student should be able to answer questions about the relationship between uses of energy and population changes.



Developed by: Shirley Barnes
Beaverton School Dist.
Beaverton, OR

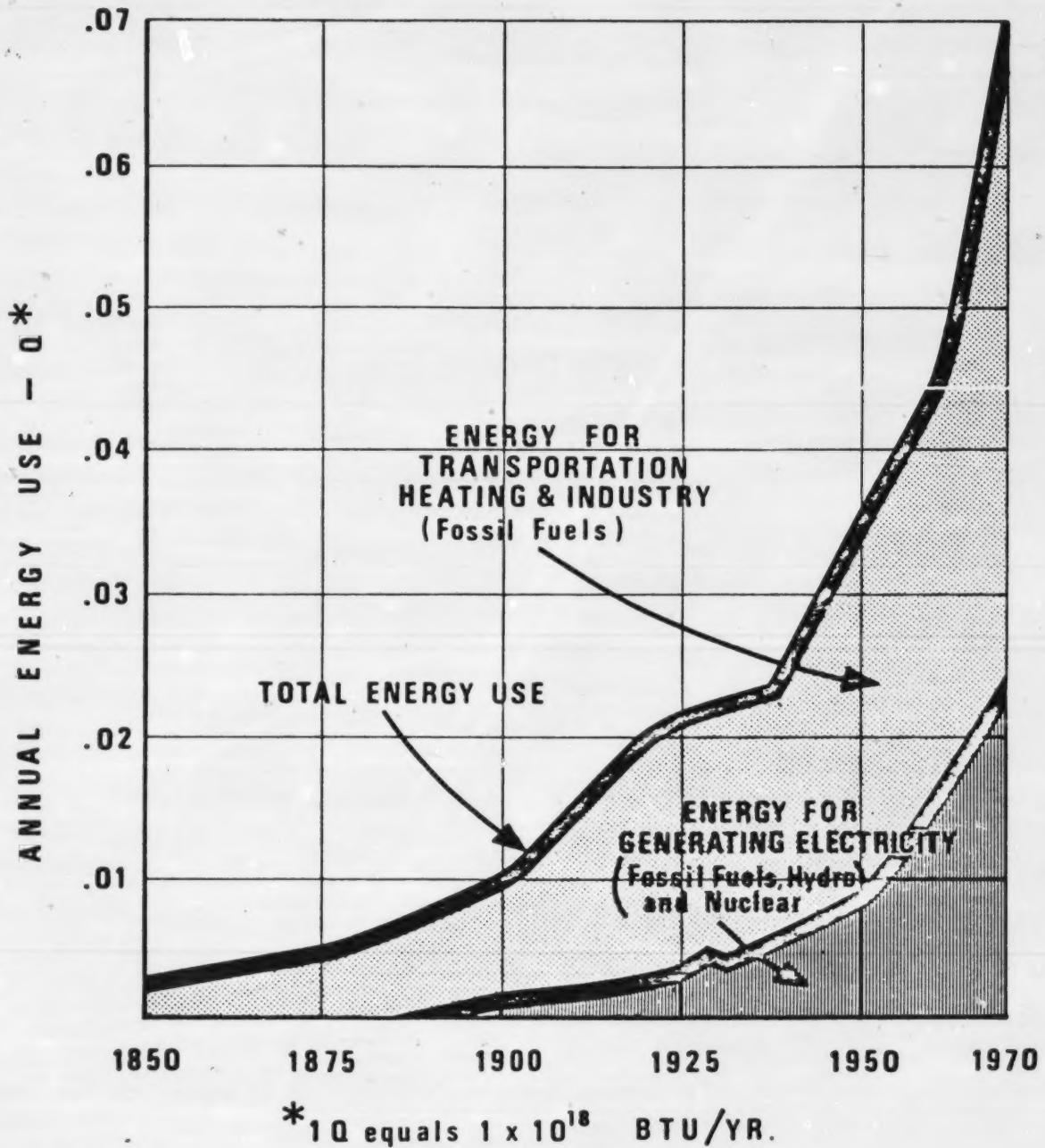
Revised by: Dan Grimes
EME



activities



U.S. ENERGY HISTORY



LIMITS

FUTURE SOURCES OF ENERGY

GOAL :

IT IS ESSENTIAL THAT EACH PERSON KNOW
THAT NEW ENERGY SOURCES AND MORE EFFICIENT
SYSTEMS, ACCOMPANIED BY DIFFERENT CONSUMPTION
PRACTICES MAY ALTER THE WORLD ENERGY DILEMMA.



ACTIVITY
DESCRIPTION PAGE
FUTURE (4-6)

Goal: It is essential that each person know that new energy sources and more efficient systems, accompanied by different consumption practices may alter the world energy dilemma.

Concept: Energy availability will affect future lifestyles and cultural conditions.

Activity #1 "Will It Change Our Lifestyle?"
Grade level 4-6 Time: 7 - 30 minute
Science, Social Science, Art, sessions
Language Arts
Given the opportunity, the student will be able to determine that lifestyles in the future may differ from the present because of changes in energy availability and new developments in the field of energy.

Concept: Future energy technologies will be judged by their combined economic, social, political, technical and environmental impacts.

Activity #2 "New Energy Sources"
Grade level 4-6 Time: 15 - 30 minute
Science, Career Education sessions
Given the opportunity, the student will write a description of a new technology that is helping an old energy source become more efficient or new technology that is developing new sources of energy.

Concept: "The Choice Is Yours"
Grade level 5-6 Time: 2 - 30 minute
Science sessions
Given the opportunity, the student will consider several choices that may be taken to help us meet the energy needs of the future, make judgments of the choices offered, and be able to defend his/her selections.

Concept: New energy technology may be developed in the future.

Activity #4 "An Artistic Creation!"
Grade level 5-6 Time: 4 - 30 minute
Art sessions
Given the opportunity, the student will create and design, using available art materials, an energy-producing model limited only by imagination and materials available on earth.

title: "Will It Change Our Lifestyle?"



future



concept: Energy availability will affect future lifestyles and cultural conditions.

objective: Given the opportunity, the student will be able to determine that lifestyles in the future may differ from the present because of changes in energy availability and new developments in the field of energy.

time: 7 - 30 minute sessions

subject matter area: Science, Social Science, Art, Language Arts

grade: 4-6

implementation:

- Activity: 1. Have a teacher-led discussion to stimulate student thought on the subject of future energy sources and uses and the effects of such on our lifestyles. The teacher could ask the students to list some of the energy sources being presently considered for development as "pollution-free" sources. Possible responses might be: solar, tidal or wind energy.
2. Ask each student to choose one of the energy sources listed and on a sheet of paper list the various effects major use of this particular energy source would have upon our lifestyles. Have the students share the results of their lists. A possible example would be the adoption of solar energy as a major power source. The following question could then be asked, "How would the adoption of solar energy affect architecture, land use, job skills, etc.?" Possible answers to this question might be:
- Effect upon architecture - Houses and other building structures would have to be designed to make the best use of the sun's rays. Considerations would have to be given to the roof slant, material used to construct the roof, color used, etc.

materials:



Power Generation Alternatives, Seattle City Light, Cone Heiden Corporation, 1972.



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implementation:**Activities:**
(cont.)

- b. Land use - Constructions of a method to collect and store solar energy offers a challenge. Solar cell devices could be used commercially or a "solar farm" could be developed. The solar farm would involve the placement of solar cells over a vast area of flat land. This array would have to be coupled with facilities for storage and transmission of energy. Besides cost, another large drawback of this idea would be that in an area such as Puget Sound, in Washington, nearly 15,000 acres would have to be covered with solar cells in order to satisfy Seattle's electric needs. (Refer to: Power Generation Alternatives, Seattle City Light, Cone Heiden Corporation, 1972.) What effect would this amount of "land coverage" have upon our environment?
 - c. Job skills - People would be needed to construct the solar cells. People would have to be trained in maintenance of the solar cell devices being commercially used. People would have to be trained in areas of engineering and technology. (For example, large satellites or solar collectors might be used in space to collect the sunlight, transmit it to an energy converting space station and then beam the energy to receiving stations on earth.)
3. Have each student use the energy source chosen in activity 2 and, for creative writing, develop a story and illustrations showing "My Community Runs on (student's choice) Power." Have students include as many examples as possible demonstrating the effects of this particular power source upon architecture, land use and job skills.
4. Place the completed stories on display in the room.

materials:**SUGGESTED ASSESSMENT PROCEDURE:**

Given the opportunity to produce the lists in activity 2 and the stories and illustrations in activity 3, the student should progress toward the stated objectives.

Developed by: Shirley Barnes
Beaverton School District
Beaverton, OR

Revised by: Dan Grimes
EME

title: "New Energy Sources"



future



concept: Future energy technologies will be judged by their combined economic, social, political, technical and environmental impacts.

objective: Given the opportunity, the student will write a description of a new technology that is helping an old energy source become more efficient or new technology that is developing new sources of energy.

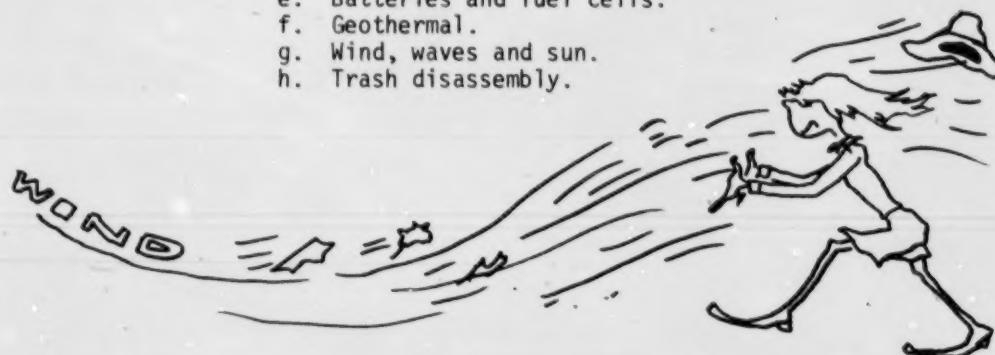
time: 15 - 30 minute sessions

subject matter area: Science, Career Education

grade: 4-6

implementation:

- Activity: 1. The following subject areas are listed on the board and students choose which area they would like to study as research teams:
- Fossil fuels.
 - Hydroelectricity.
 - Engines and turbines.
 - Fission.
 - Batteries and fuel cells.
 - Geothermal.
 - Wind, waves and sun.
 - Trash disassembly.



materials:



Materials from EME, School and Public Library:

"The Environmental Impact of Electrical Power Generation: Nuclear & Fossil," Nature/Science Annual, 1974

"Turning Garbage into Gold." Time/Life, 1974

U.S. Atomic Energy Commission, 1973, "The Search for Tomorrow's Power," National Geographic, November 1972

The BFA Educational Media, Energy Sources, sound filmstrips, are essential as they provide a firm basis for all areas except trash disassembly. A good basis for trash disassembly research is the article, "Turning Garbage into Gold."

implementation:

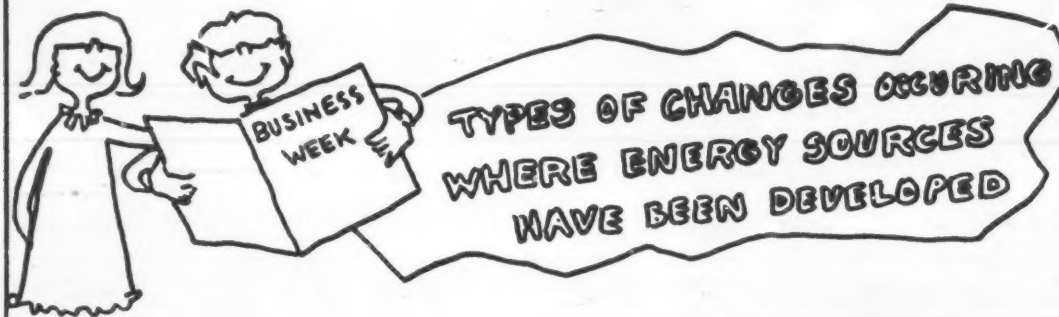


Activities: 2.
(cont.)

After sufficient study time has elapsed, have the students explain the process they studied to the class, using their research information, plus models, visual aids or any material that would help describe the energy source.

SUGGESTED CAREER AWARENESS ACTIVITY:

Have the students describe the new jobs that would be created through the use of the energy source.

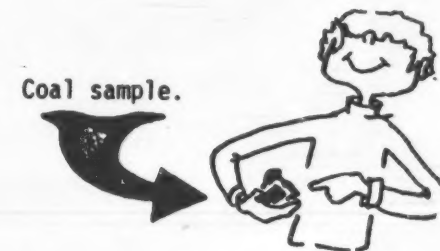


materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, the students will research a topic and present their information to the class.



Developed by:

Ed Walters
Crest Drive School
Eugene, OR

Revised by:

Dan Grimes
EME

title: "The Choice Is Yours"



future



concept: Energy availability will affect future lifestyles and cultural conditions.

objective: Given the opportunity, the student will consider several choices that may be taken to help us meet the energy needs of the future, make judgments of the choices offered, and be able to defend his/her selections.

time: 2 - 30 minute sessions

subject matter area: Science

grade: 5-6

implementation:

Activity: 1.

The following five statements are written on a chalkboard or handed out on ditto sheets presenting various points of view on possible solutions to our future energy needs:

- a. Electrical energy is the key to economic growth; if we must pollute the environment to get the electricity, it is a small price to pay.
- b. Electrical energy will be in short supply in the years ahead; but if this generation can operate with the available supply, the next generation can take care of itself.
- c. If our lifestyle can be changed so that we use less material goods and, consequently, less energy we must do so, even if it means going back to a 1900 standard of living.
- d. We must have a clean environment even at the cost of economic growth; therefore, any fuel that will be used to generate electricity that will cause pollution should be banned from use.
- e. It is probably necessary that we will have some pollution in our efforts to produce enough electrical energy in the years ahead; we should accept this as a necessary evil to gain economic growth.

materials:

Paper
Pencil



implementation:



- Activities: 2. Each student is then asked to rank these statements on an individual basis from most desirable to least desirable.
(cont.)
3. The class is then split into groups of three to six students. Each group is asked to come up with a rank order of the statements, which will necessitate an individual stating his/her choices and then arriving at a group consensus.
4. Each group will then report its ranking to the rest of the class with discussion concerning reasons for their choices.

SUGGESTED CAREER AWARENESS ACTIVITY:

Group students to represent a person with the point of view of each of these statements (a citizen, government official, industry person, utility person, etc.). Have the students try to persuade the "audience" to their point of view. Present these "issues" to another class. The second class will then vote as citizens on prepared ballots to determine their preferences on stated issues.

materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, the student will rank-order five energy related statements as an individual and in a group.



Developed by: Ed Walters
Crest Drive School
Eugene, OR

Revised by: Dan Grimes
EME

title: "An Artistic Creation!"



future



concept: New energy technology may be developed in the future.

objective: Given the opportunity, the student will create and design, using available art materials, an energy-producing model limited only by imagination and materials available on earth.

time: 4 - 30 minute sessions

subject matter area: Art

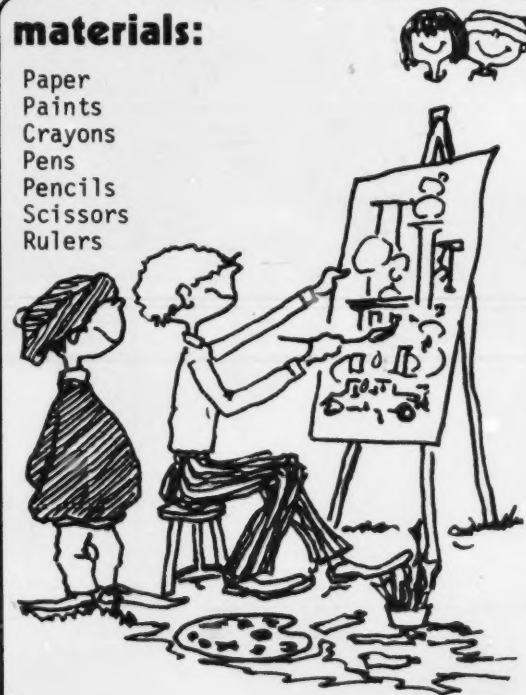
grade: 5-6

implementation:

- Activity:
1. This entire lesson is planned as an art pretest to see if, ultimately, the students can incorporate new knowledge into their art activities.
 2. Hold a class discussion posing the following questions and writing the responses on the chalkboard:
 - a. What is energy?
 - b. Where does man get energy?
 3. As a project, ask the students to create a model or depiction of an energy-producing model in an art project. Allow necessary time - several periods, possibly - to complete project.
 4. Each student should present and explain his/her model to the class.
 5. All projects should be displayed in the classroom with a number attached. Students should categorize them under these headings:
 - a. Artistic.
 - b. Imaginative.
 - c. Practical.

materials:

Paper
Paints
Crayons
Pens
Pencils
Scissors
Rulers



implementation:



Activities: 6.
(cont.)

Teacher could also categorize projects under an alternate set of categories such as:

- a. Artist's solutions.
- b. Imaginative solutions.
- c. Scientist's solutions.
- d. Use of energy sources.

(Note: The teacher may choose to add other imaginative categories, de-emphasizing which are "best.")

SUGGESTED CAREER AWARENESS ACTIVITY:

As a class, select one of the students imaginative solutions and create the job responsibilities needed to operate the invention.

materials:



SUGGESTED ASSESSMENT PROCEDURE:

Given the opportunity, the student will be able to design a model depicting a future energy-producing system.



Developed by: Ronald L. Vincent
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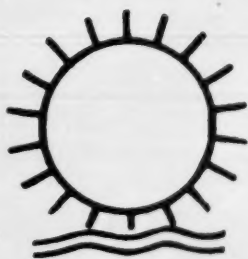
Revised by: Dan Grimes
EME

STUDENT ASSESSMENT

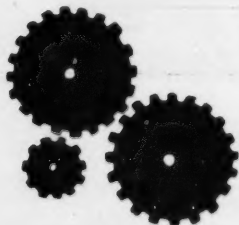
ENERGY AND CONSERVATION EDUCATION

Activities for the Classroom

Grades 4-6



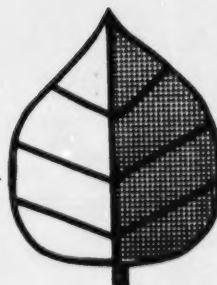
SOURCES



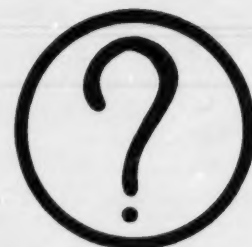
USES



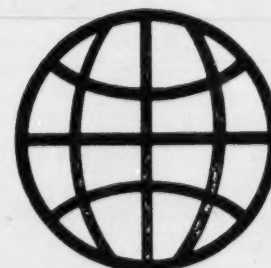
CONVERSIONS



IMPACTS



FUTURE



LIMITS



STUDENT ASSESSMENT

Using The Suggested Test Items

The following test items are examples only and are not intended to be the final assessment for the entire notebook. The instructor may wish to select questions from this list to judge the preparedness of the students or to use as a nucleus for a final test covering all areas of the notebook.

Origin Of Test Items

Each test item is derived from a corresponding learning activity. For example, a suggested test item has been prepared from Sources, Activity #1. A test item has been suggested for each activity.

Type Of Suggested Test Items

Most of the test items are multiple choice, true or false, completion, "fill in the blank," or class discussion questions. For the convenience of the teacher, a "key" has been prepared, giving the answer to each question.



SUGGESTED TEST ITEMS

Grades 4 - 6

SOURCES OF ENERGY:

- Activity #1: 1. The word petroleum means:
a. - oil.
b. - water power.
c. - used clothing.
d. - None of the above.
- Activity #2: 2. Which of the following is not a renewable energy source?
a. - food.
b. - uranium.
c. - water.
d. - None of the above.
- Activity #3: 3. Name three (3) future energy sources we are now developing and putting to use.
a. _____ b. _____ c. _____
- Activity #4: 4. The sun is an energy source and is the original source of almost all of our energy.
a. - True.
b. - False.
- Activity #5: 5. Which color would be the best absorber of heat?
a. - red.
b. - white.
c. - black.
d. - green.
e. - None of the above.
- Activity #6: 6. How did primitive people hundreds of years ago communicate with each other?
a. - sign language.
b. - drawing pictures.
c. - All of the above.
d. - None of the above.
- Activity #7: 7. Name three (3) ways wind might be used as a power source.
a. _____ b. _____ c. _____

SUGGESTED TEST ITEMS

Grades 4-6

USES OF ENERGY:

- Activity #1 1. The phrase "conserving energy" means to:
a. - increase the amount of energy used.
b. - reduce the amount of energy used.
c. - not change the amount of energy used.
d. - none of the above.
- Activity #2 2. Name three (3) ways paper products can be conserved.
a. - _____
b. - _____
c. - _____
- Activity #3 3. Sacrifices have to be made when a person conserves energy.
a. - True.
b. - False.
c. - Opinion statement.
- Activity #4 4. Which of the following is an example of conserving energy?
a. - leaving lights on.
b. - leaving the TV set on.
c. - turning down the heat in the home.
d. - taking long, hot showers.
- Activity #5 5. Which of the following appliances uses the most energy?
a. - dishwasher.
b. - toaster.
c. - refrigerator.
d. - hot plate.
- Activity #6 6. Which of the items listed cannot be re-used or recycled?
a. - empty toothpaste tube.
b. - empty can.
c. - old newspaper.
d. - broken pencil.
e. - all of the above.
f. - none of the above.
- Activity #7 7. The making of toys in factories requires a great deal of energy.
a. - True.
b. - False.
- Activity #8 8. The amount of energy used in the U.S.A. in the early 1900's was less as compared to today because:
a. - the population was less.
b. - technology was not as advanced.
c. - energy was less important.
d. - none of the above.
e. - all of the above.
f. - only a & b.

(over)

USES, Cont'd:

- Activity #9 9. Leisure time activities can be judged in value by the amount of money spent on them.
- a. - True.
 - b. - False.
 - c. - Opinion statement.

- Activity #10 10. CLASS DISCUSSION ABOUT ACTIVITY

- Activity #11 11. Name three (3) new energy sources people might use in the distant future.

- a. - _____
- b. - _____
- c. - _____

- Activity #12 12. Circle the following items listed that were available for people to use 100 years ago.

- a. - light bulbs.
- b. - television sets.
- c. - bicycles.
- d. - airplanes.
- e. - Clothes irons.
- f. - Electric stoves.

- Activity #13 13. Not appropriate.

- Activity #14 14. The term "compromise" means to:

- a. - disagree with someone.
- b. - promise someone something.
- c. - come to an agreement.
- d. - none of the above.

- Activity #15 15. Name two ways decisions are made by citizens in a community.

- a. - _____
- b. - _____

- Activity #16 16. Complete the following sentence with the most appropriate phrase below. A mine worker _____.

- a. - is a future energy source.
- b. - works underground.
- c. - uses oil to help it run.
- d. - uses the sun's energy.

- Activity #17 17. Name one place of business and list the major energies it uses.

(Continued on next page)

USES, Cont'd:

Activity #18 18. Check the items below that were used by many people during the 1600's-1800's.

- a. - electric range.
- b. - wood stove.
- c. - cars.
- d. - coal burning stoves.
- e. - electric ovens.
- f. - electric dishwasher.
- g. - airplanes.
- h. - trains.
- i. - horses.
- j. - television.

Activity #19 19. Which energy sources below are fossil fuels?

- a. - oil.
- b. - nuclear.
- c. - wind.
- d. - sun.
- e. - wood.
- f. - water.
- g. - plants.
- h. - coal.

Activity #20 20. Clothing is made from

- a. - coal.
- b. - wind.
- c. - ocean currents.
- d. - geothermal.
- e. - none of the above.



SUGGESTED TEST ITEMS

Grades 4 - 6

CONVERSIONS OF ENERGY:

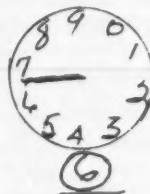
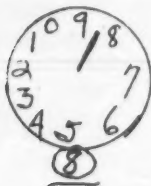
- Activity #1 1. When light energy is changed into heat energy, it can be:
a. - seen.
b. - felt.
c. - heard.
d. - all of these.
- Activity #2 2. A bar graph will give information that tells you:
a. - what to do.
b. - what not to do.
c. - comparisons.
d. - predictions.
- Activity #3 3. A radiometer absorbs the same amount of heat whether the light source is close or distant.
a. - True.
b. - False.
Defend your answer, based on your experiment.
- Activity #4 4. When a hot dog cooks, what happens to the energy it absorbs?
(Note to class teacher: Have a CLASS DISCUSSION)
- Activity #5 5. A water wheel, a steam turbine and a windmill are very much alike. What do they have in common?
a. - _____
- Activity #6 6. What are two words that are like kinetic?
a. - _____
b. - _____
What are two words that are like potential?
a. - _____
b. - _____
- Activity #7 7. Pick the statement you most agree with and then write a paragraph describing why you agree.
a. - All goals are equal.
b. - All goals are not equal.
c. - Goals may change.
d. - One person's goals may not be the same as another person's goals.
- Activity #8 8. If children in another country read a story about things an American person likes to do, would they be happy about the same things?
Have a CLASS DISCUSSION.
- Activity #9 9. If you were to make a solar heating unit, would you most likely use:
a. - dark colors. c. - alternate colors.
b. - light colors d. - none of these.

SUGGESTED TEST ITEMS

Grades 4 - 6

IMPACTS OF ENERGY:

- Activity #1: 1. If you were to place a piece of cheese cloth over the exhaust of a car you could expect to find which of the following materials on the cheese cloth?
- carbon dioxide.
 - soot.
 - sand.
 - insects.
- Activity #2: 2. Write a short paragraph comparing transportation today with transportation in your grandparents younger years. (answers will vary)
- Activity #3: 3. Three groups of plants were treated with different fertilizers. A fourth group was untreated. This last group would be called a/an:
- experiment.
 - control group.
 - growth group.
 - All of the above.
- Activity #4: 4. Zones on local maps are determined by:
- federal government.
 - business.
 - local government.
 - available water.
- Activity #5: 5. What is in an Environmental Impact Statement?
- Activity #6: 6. Given the following data, students will construct a bar graph of trash weight.
- | Day | Weight |
|-----|---------|
| 1 | 10 kg |
| 2 | 10.5 kg |
| 3 | 8.7 kg |
| 4 | 8.2 kg |
| 5 | 7.5 kg |
| 6 | 7.0 kg |
- Activity #7: 7. CLASS DISCUSSION directed at methods being used to clean up the environment.
- Activity #8: 9. What meter reading do these meters represent?



IMPACTS, Cont'd.

Activity #9: 9. List four things done in an industrial plant to help keep it clean.

- a. _____
- b. _____
- c. _____
- d. _____

Activity #10: 10. Teachers might use a method such as values votes to assess students' feelings toward this issue.
CLASS DISCUSSION.

Activity #11: 11. Which of the following might be listed as good effects of a new railroad on a frontier town by a business man?

- a. - smoke.
- b. - travelers.
- c. - new markets.
- d. - train station.
- e. - fewer horses.

CLASS DISCUSSION on each selected. Students should be able to present reasonable reasons why increased travelers, for example, would be helpful for a business person.

Activity #12: 12. Some industrial waste can be:

- a. - used for fuel.
- b. - food for animals.
- c. - a raw materials for another industry.
- d. - All of the above.

Activity #13: 13. What is an environmental trade-off?

Activity #14: 14. CLASS DISCUSSION.

Activity #15: 15. Which of the following could have been the leading cause of the Civil War?

- a. - energy use.
- b. - President Lincoln.
- c. - differences between the industrial North and the agricultural South.
- d. - the Indian wars.

Activity #16: 16. CLASS DISCUSSION.

Activity #17: 17. Using the film "Junkyard", have students list examples of:

- a. - metal land pollutants.
- b. - wood land pollutants.
- c. - other land pollutants.

Activity #18: 18. Define: energy; biodegradable; impact.

SUGGESTED TEST ITEMS

Grades 4 - 6

LIMITS OF ENERGY:

- Activity #1 1. Pick one statement and discuss with the class.
a. - All people should have an equal amount of energy to use.
b. - All energy uses cannot be equal for all people.
c. - All energy usage is equal for all people.
- Activity #2 2. Our most abundant fossil fuels are:
a. - renewing rapidly.
b. - not renewing.
c. - renewing very slowly.
d. - none of the above.
- Activity #3 3. Underline the words that could describe "limited".
scarce, abundant, nonexistent, known, forever, everlasting
- Activity #4 4. What does the word conservation mean?
a. - political party.
b. - to waste.
c. - not to waste.
d. - None of the above.
- Activity #5 5. Discuss the play (effect and affects).
- Activity #6 6. If schools used less energy, the schools would be:
a. - better.
b. - not as good.
c. - happier places.
d. - less happy places.
e. - It's hard to give an answer.
- Activity #7 7. Class discussions or plan the ideal community on a
new planet (like Earth).
(Not a pre-test item)..

SUGGESTED TEST ITEMS

Grades 4 - 6

FUTURE ENERGY SOURCES:

- Activity #1 1. The amount of energy sources a nation possesses could determine its life style.
a. - True
b. - False
- Activity #2 2. Which statement is most correct?
a. - Technology comes before research.
b. - Research comes before technology.
c. - Research and technology occur at the same time.
- Activity #3 3. CLASS DISCUSSION
- Activity #4 4. Art and science are much alike- CLASS DISCUSSION

ANSWER KEY
Grades 4 - 6

SOURCES OF ENERGY

- Activity #1: a
#2: b
#3: (solar, ocean currents, nuclear,
wind, tidal, garbage)
#4: a
#5: c
#6: c
#7: (sail boats, wind mills, kites,
gliders, etc.)

USES OF ENERGY

- Activity #1: b
#2: answers will vary
#3: T
#4: c
#5: a
#6: f
#7: T
#8: f
#9: c
#10: -
#11: answers will vary
#12: 3 and 5
#13: -
#14: c
#15: answers will vary (e.g. by voting,
committee, elected officials, etc.)
#16: b
#17: answers will vary
#18: b, d, h, and i
#19: a and h
#20: e

CONVERSIONS OF ENERGY

- Activity #1: d
#2: c
#3: F
#4: -
#5: they turn and are propelled by an energy source.
#6: answers will vary (moving, active)
#7: answers will vary (moving, etc.)
#8: CLASS DISCUSSION
#9: a

IMPACTS OF ENERGY

- Activity #1: b
#2: answers will vary
#3: b
#4: c
#5: Students should understand that this would explain proposed effect of changes.
#6: -
#7: answers will vary
#8: -
#9: educate workers; provide trash containers; punish "messy persons"; post clean-up posters.
#10: CLASS DISCUSSION
#11: 2,3,4 and 5
#12: d
#13: a decision made in which some good and some bad effects are involved within an environmental framework.
#14: CLASS DISCUSSION
#15: c
#16: CLASS DISCUSSION
#17: a. (cars, cans, oil)
b. (paper, old buildings, phone poles)
c. (plastics, signs)
#18: energy: ability to do work;
biodegradable: able to be destroyed by a living organism;
impact: the effect of an act.

ANSWER KEY
Grades 4 - 6 (Cont'd.)

LIMITS OF ENERGY

- Activity #1: -
#2: c
#3: scarce, known
#4: c
#5: -
#6: e
#7: -

FUTURE ENERGY SOURCES:

- Activity #1: T
#2: research comes before technology
#3: -
#4: -